Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

ECHNOLOGY DEPT.

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DEPARTMENT

BACKGROUND TO I.C.I. PLASTICS

Production for World Markets

Keeping pace with the world demand for plastics, I.C.I.'s modern plants produce a wider range of plastic material than that of any other manufacturer. This Banbury mixer is part of the polyvinyl chloride plant at the I.C.I. Plastics Division Hillhouse Works at Fleetwood, Lancashire.

● *P.V.C. polymer and plasticised P.V.C. compound are sold under the registered trade marks 'CORVIC' and 'WELVIC'*

IMPERIAL CHEMICAL INDUSTRIES LTD., LONDON, S.W.1

Export enquiries should be addressed to: IMPERIAL CHEMICAL INDUSTRIES LTD. Plastics Division, Black Fan Road, Welwyn Garden City, Herts., England

ICI

P.510

COBEX

RIGID VINYL SHEET

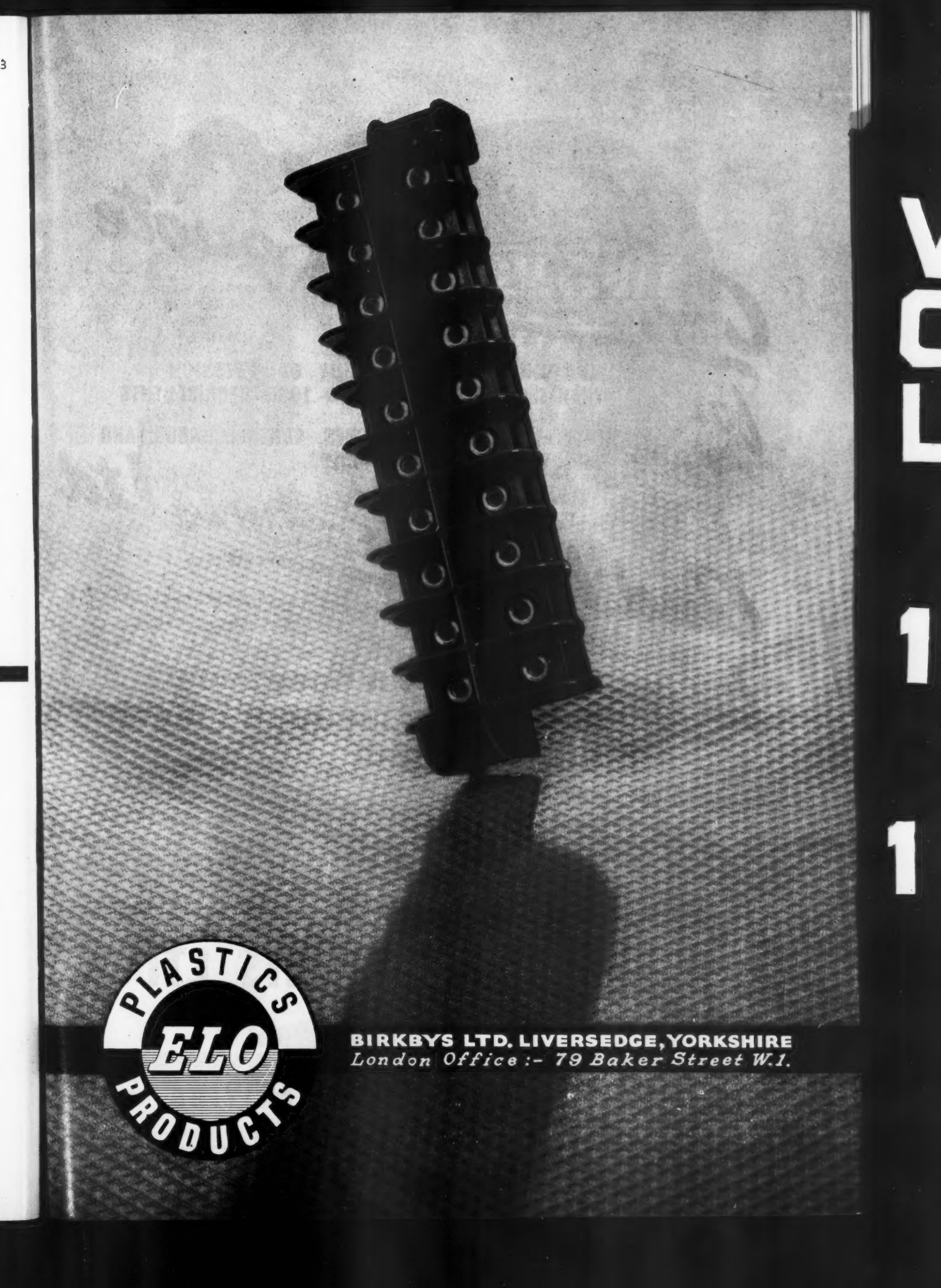
Plant for removing exhaust gases from pickling solutions, made by the Hockley Chemical Co. Ltd., entirely from COBEX.

FOR CHEMICAL RESISTANCE

Cobex is unaffected at normal temperatures by concentrated sulphuric, nitric and hydrochloric acids, and caustic soda, oxidising solutions and similar reagents.

BX PLASTICS LTD., CHINGFORD LONDON E.4. LARKSWOOD 5511

T.A.5164


PLASTICS
ELO
PRODUCTS
BIRKBYS LTD. LIVERSEDGE, YORKSHIRE
London Office :- 79 Baker Street W.1.

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for :- **MOULDINGS IN PLASTICS BY COMPRESSION TRANSFER AND INJECTION TO YOUR REQUIREMENTS**

INSULATING HANDLES, BUSHES, CONTROL KNOBS, AND TERMINALS FROM STOCK MOULDS.

And Mica Products Ltd

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MICA PRODUCTS LTD.

CRYSTALATE HOUSE

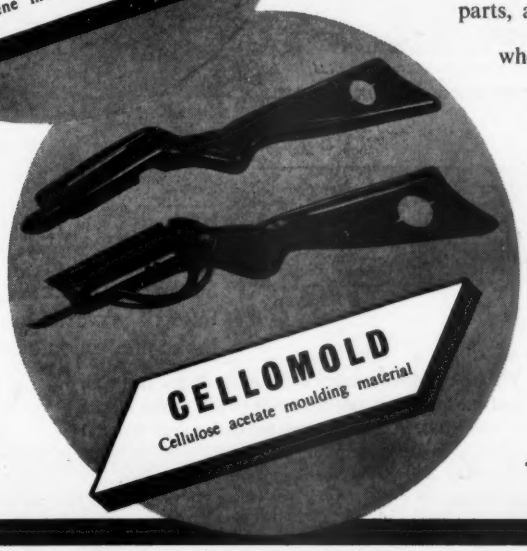
TONBRIDGE, KENT.

PHONES TONBRIDGE 2261/5 (25 LINES)

BUSINESS ESTABLISHED 1899.

World patents and patents pending. Registered design.

A DOUBLE HIT FOR BRP



THAT the clean lines of this BEEJU popgun will remain straight and true long after its young owner has relegated it to the back of his toy cupboard is assured by the choice of materials from which it was made. Because of its dimensional stability, EVB Plastics Ltd. selected DISTRENE 200 for the barrel and working parts, and used CELLOMOLD for the stock, where extreme toughness was important. These BRP moulding materials are suitable for machines of all types and capacities. Their strength, durability, surface finish and colour range afford scope for applications of the utmost variety. Details and advice on their uses are freely available from BRP.

"Distrene" and "Cellomold" are Registered Trade Marks

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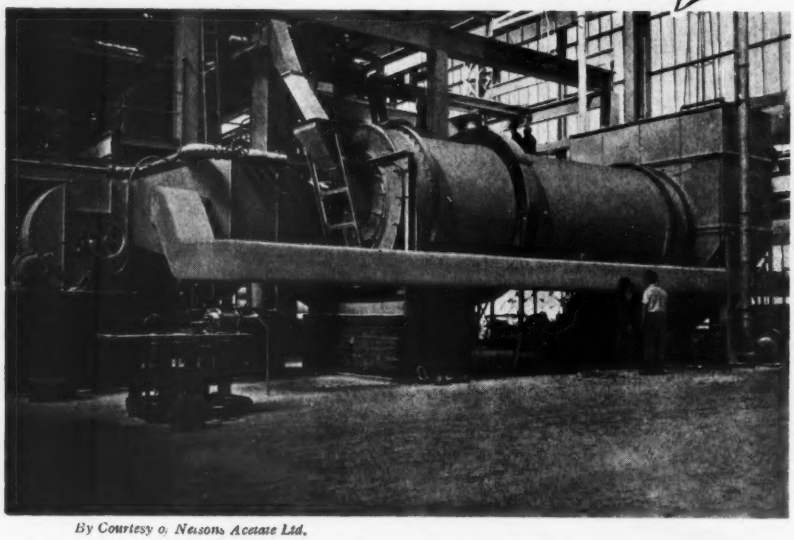

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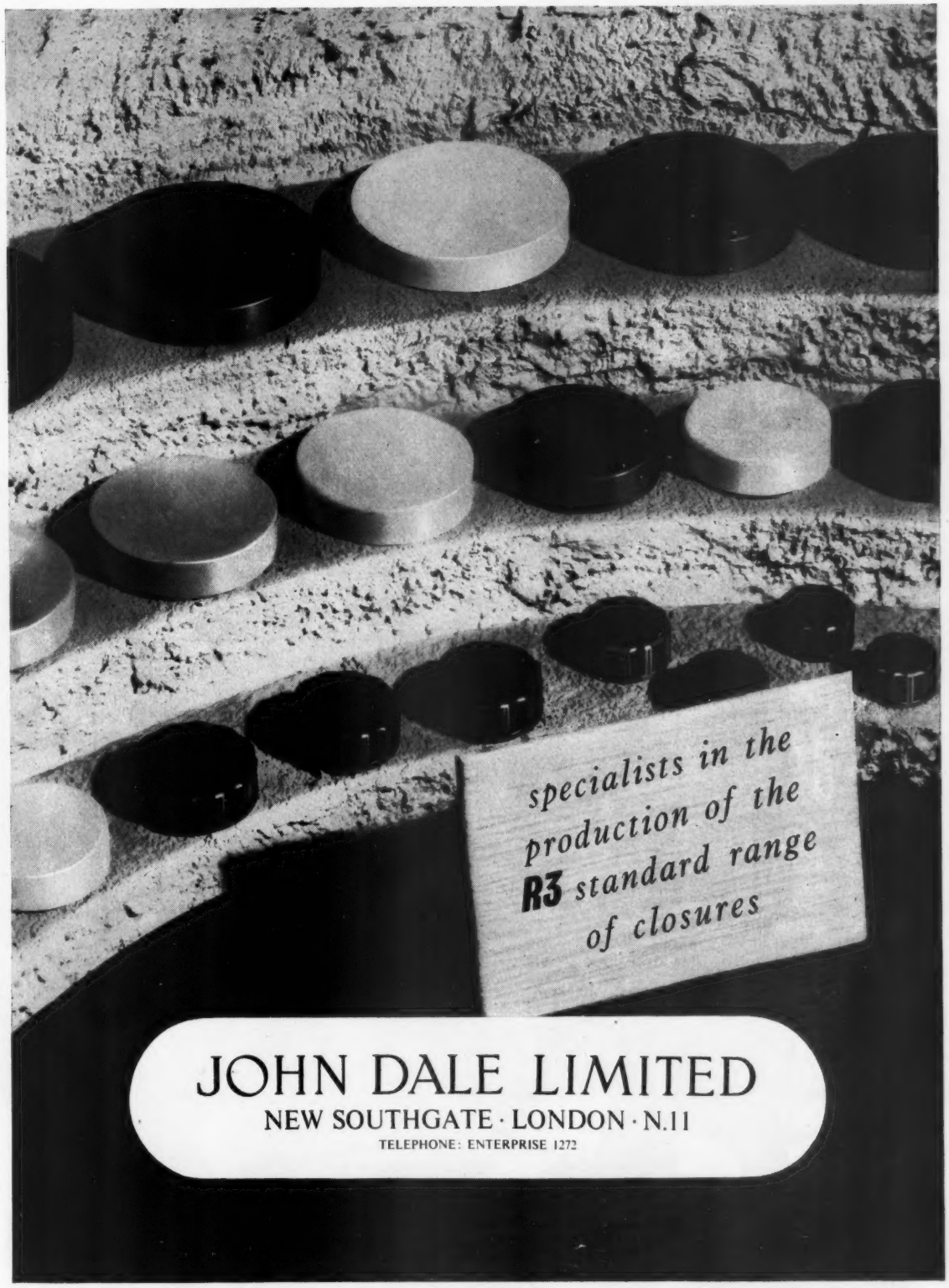
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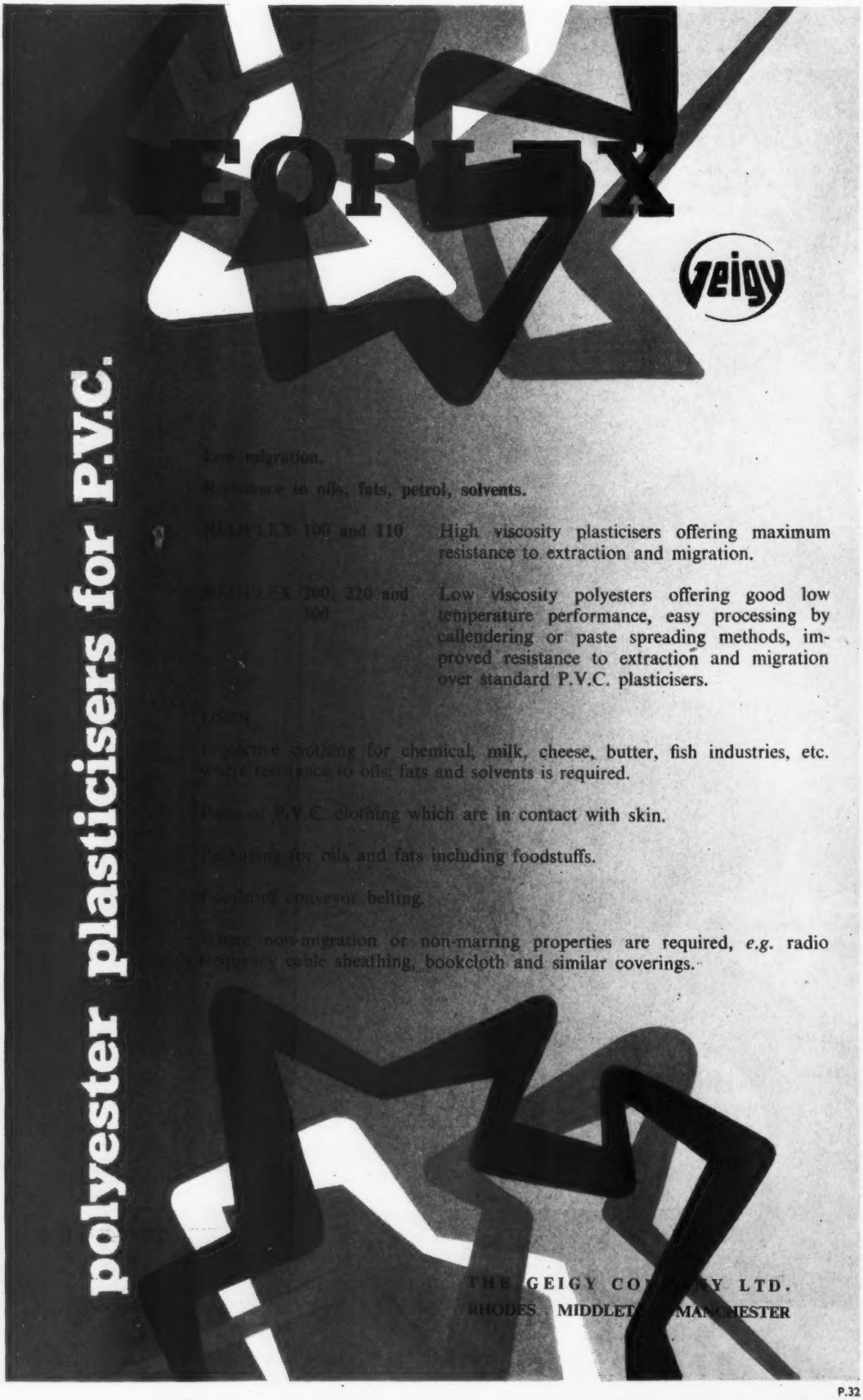
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IN OPERATION AT . . .

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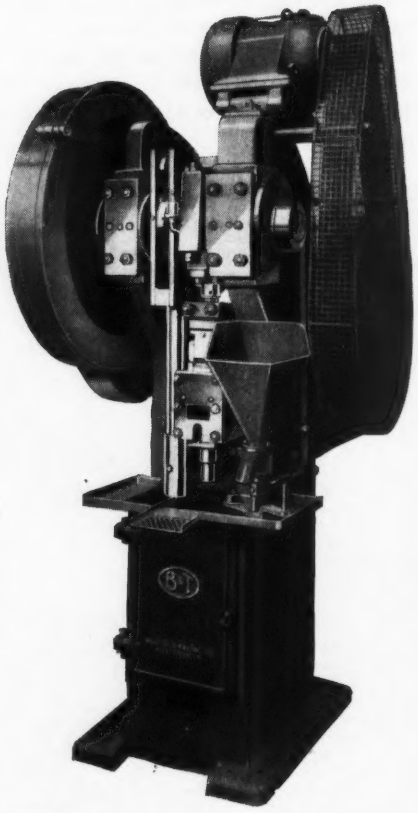

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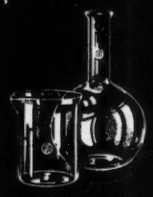

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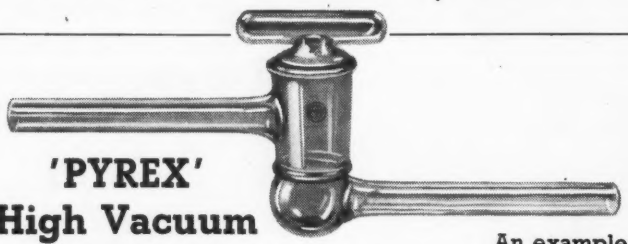

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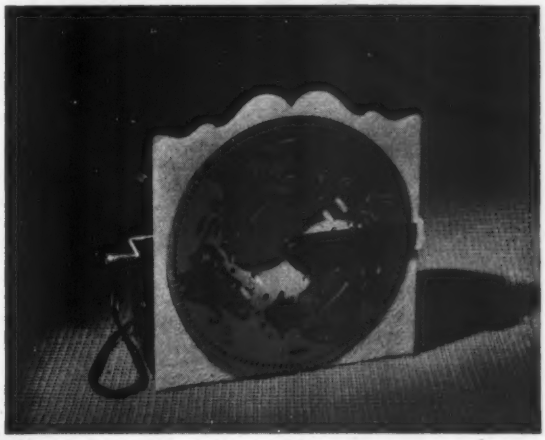

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It has a realistic tone and a repertoire of tunes is provided by means of the rapidly changed paper disc records.

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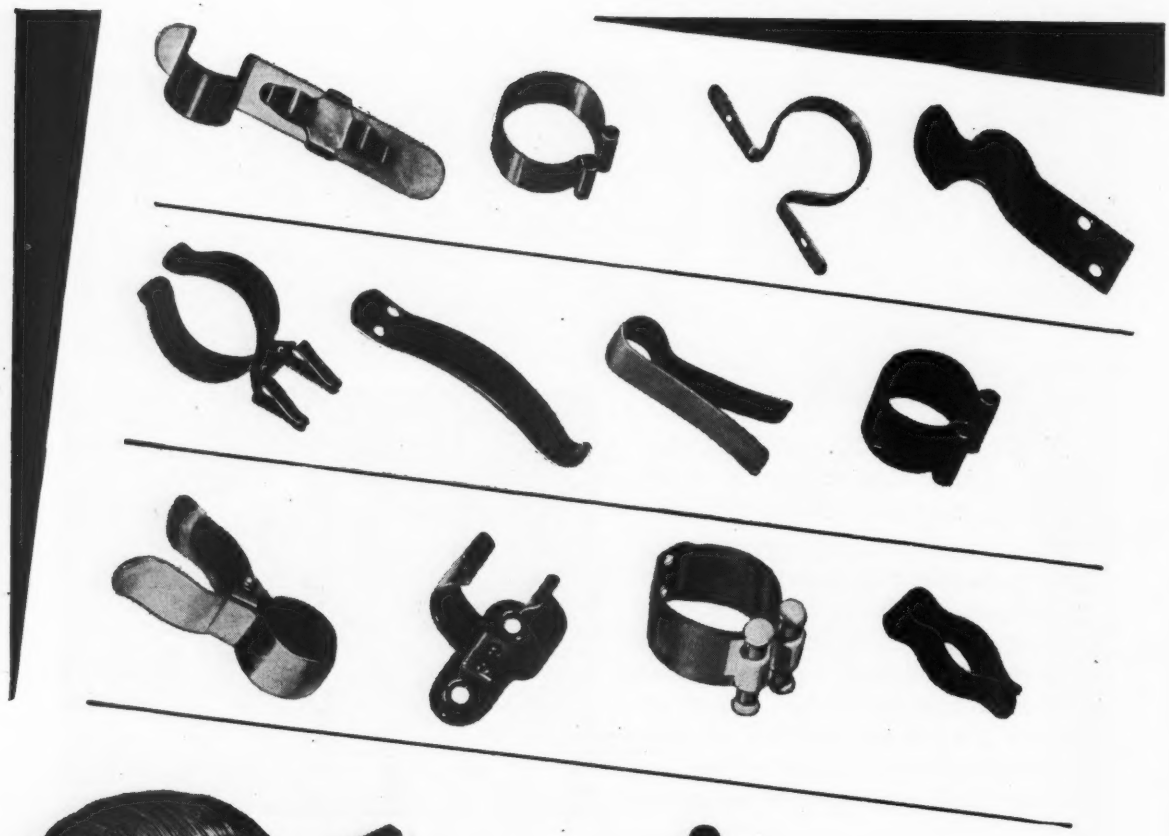

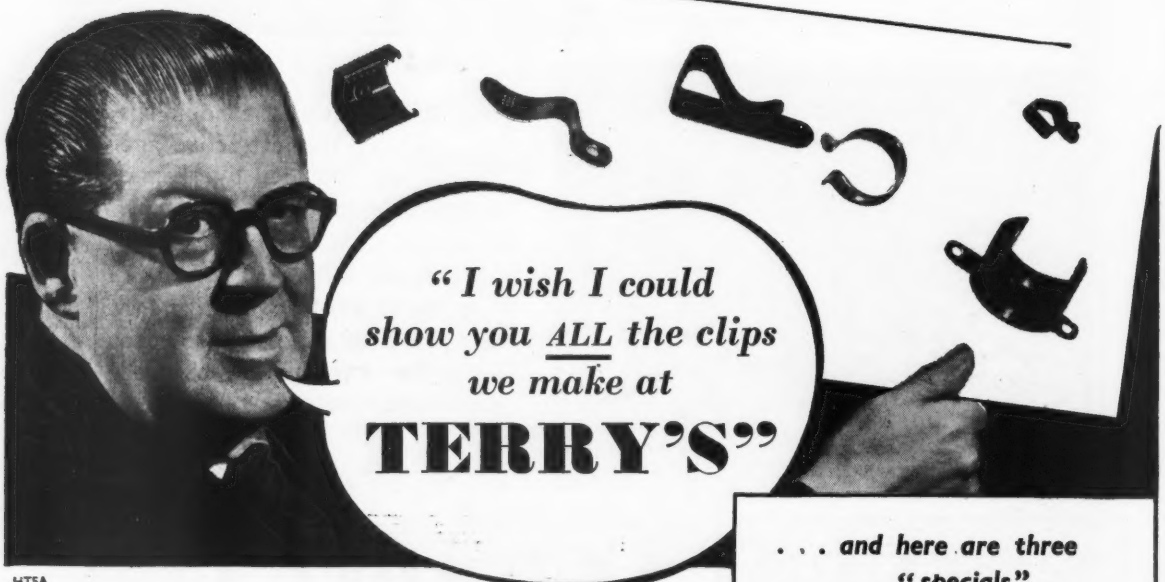

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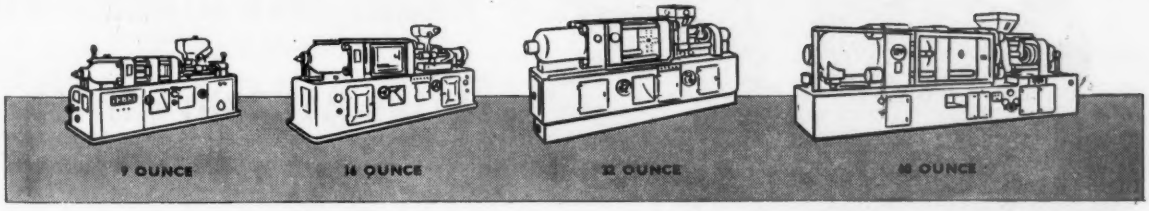
INJECTION MOULDING MACHINES



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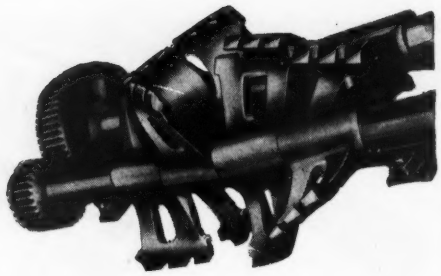

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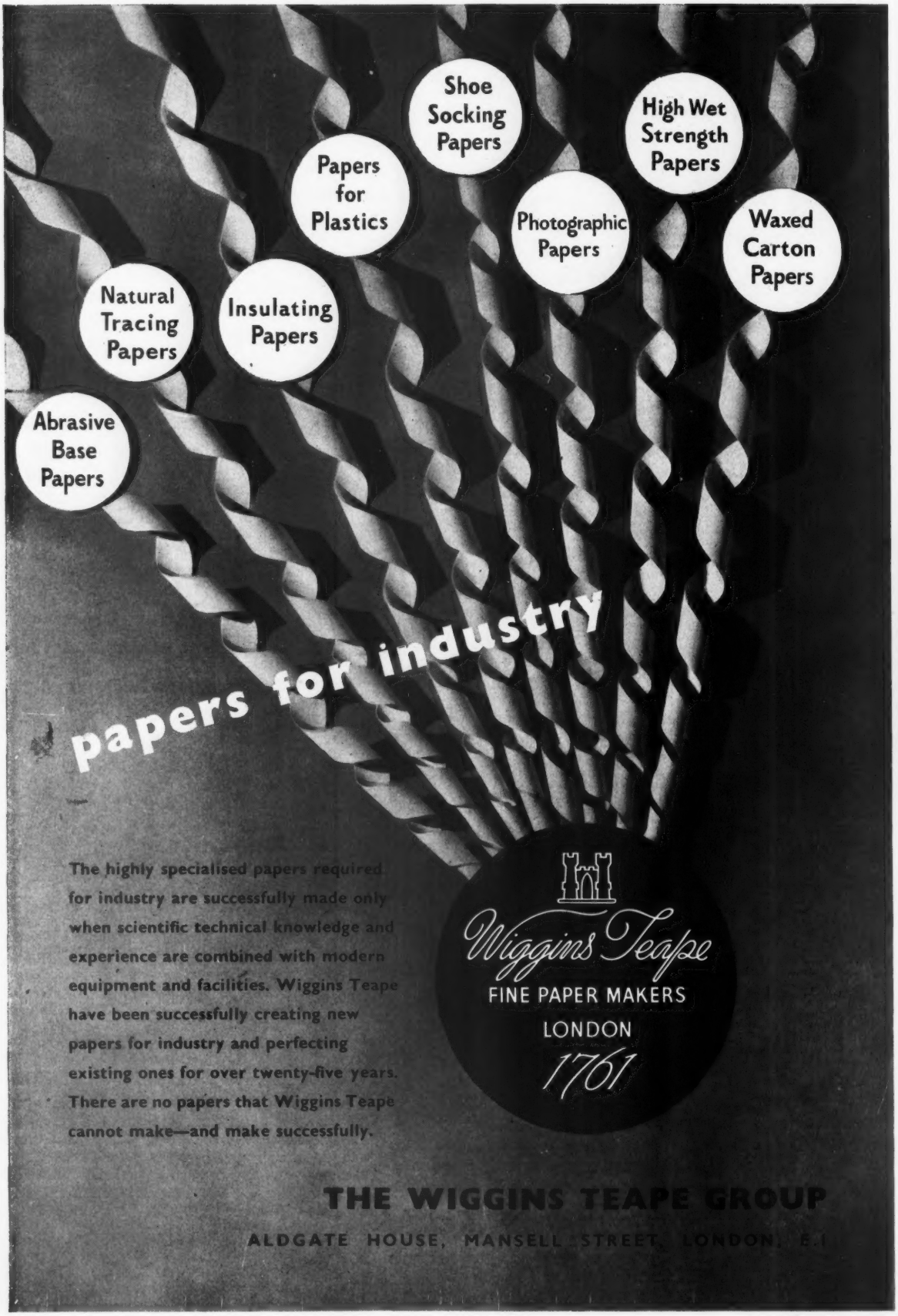
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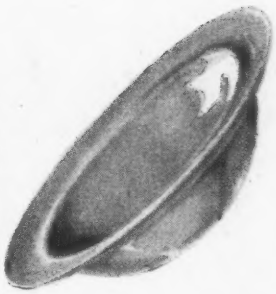

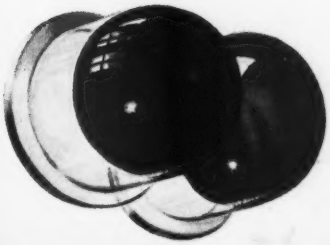

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of particular interest to technicians

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Whatever you need in plastic mouldings we are confident that we can supply it—we welcome ALL enquiries

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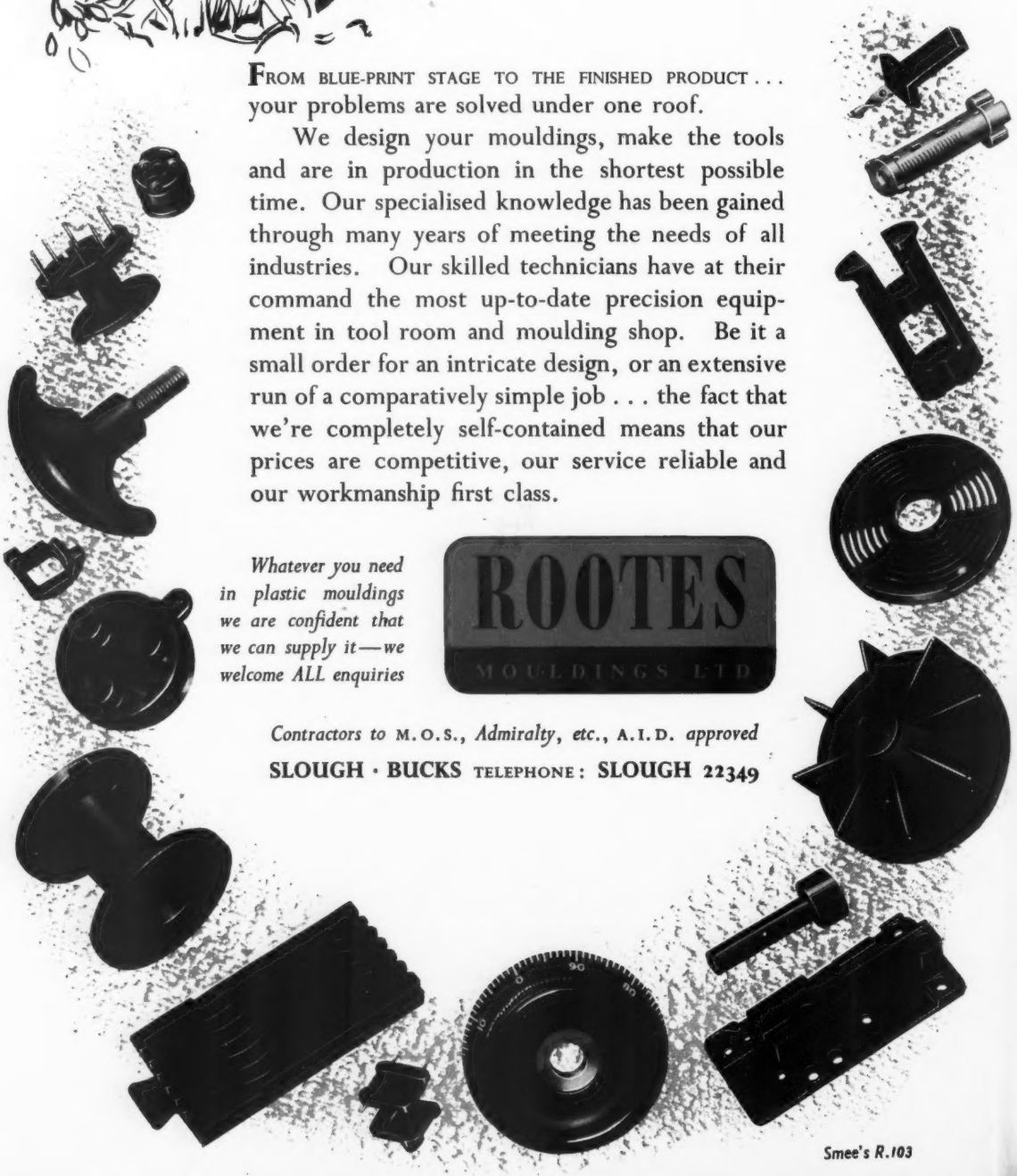

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The General Chemicals Sales Department of Monsanto Chemi
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MONSANTO'S BASIC PRODUCTS FOR THE PLASTIC INDUSTRY incl

PHENOL **CRESYLIC ACIDS** **LUSTR**

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Meta-rich Cresylics, A.D.F. Cresylics, H.B. Tar Acids, Xylenols—and many other well-known chemicals and pla

...or plastics

...*in full production*

Vehicles like this — lined, insulated and fitted with steam coils — ensure prompt, efficient delivery of Monsanto phenol to bulk users.

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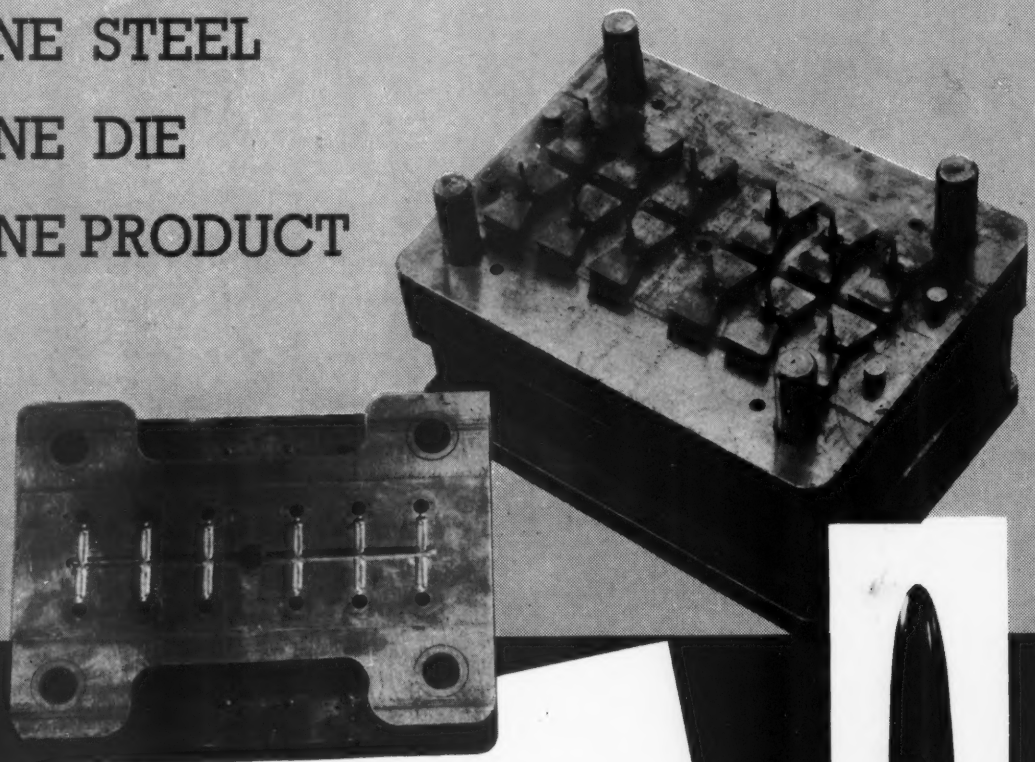
In association with :— Monsanto Chemical Company, St. Louis, U.S.A. Monsanto Canada Ltd., Montreal. Monsanto Chemicals (Australia) Ltd., Melbourne. Monsanto Chemicals of India Ltd., Bombay. Representatives in the world's principal cities.

MONSANTO

FINE STEEL
FINE DIE
FINE PRODUCT



Mould for producing the end of a Ball-point Pen made in Firth Brown Nitralloy Steels— "LK3" Steel for core pin and "HCM7" Steel for sprue bushes. Photograph by courtesy of The Metal Products (Treforest) Ltd.

DIE STEELS
PLASTICS

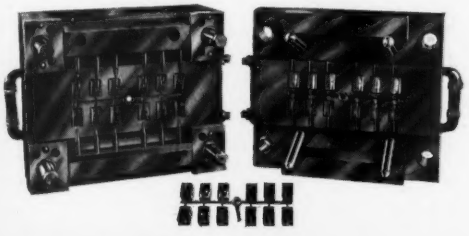
FIRTH BROWN

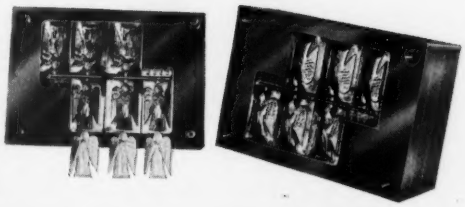
Issued by Thos. Firth & John Brown Ltd., Sheffield, England.

Windsor

PLASTIC INJECTION MOULDING MACHINES

Windsor's S.H. 3 oz. Plastic Injection Moulding Machines operating in a Scandinavian Factory.





What's YOUR Line?

Whether you manufacture toys, or an intricate component of a vital piece of machinery, R. H. Windsor Ltd. can supply the machine to produce the article.
Their Injection Moulding Machines are available from S.H. 1 oz. to S.H. 28/32 oz. models, operated either by hand or automatic cycle.

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The Windsor works at South Chessington are equipped with the most up-to-date plant for the design and manufacture of Moulds and Dies for all types of thermo-plastic materials.
Advice—and estimates without obligation.

Also Manufacturers of Multi-Screw Compounder Extruders R.C.65, R.C.100, R.C.200

Full details and specifications sent on request

SERVING THE WORLD'S PLASTIC INDUSTRY
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Telephone MONarch 8722
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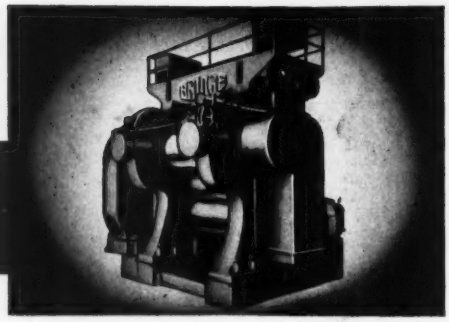
Telephone EPSOM 26345 Telegrams & Cablegrams: 'WINPLAS' SURBITON, SURREY



Precision Calender with three superimposed and one offset roller. Flood lubrication.

BRIDGE

The Hallmark

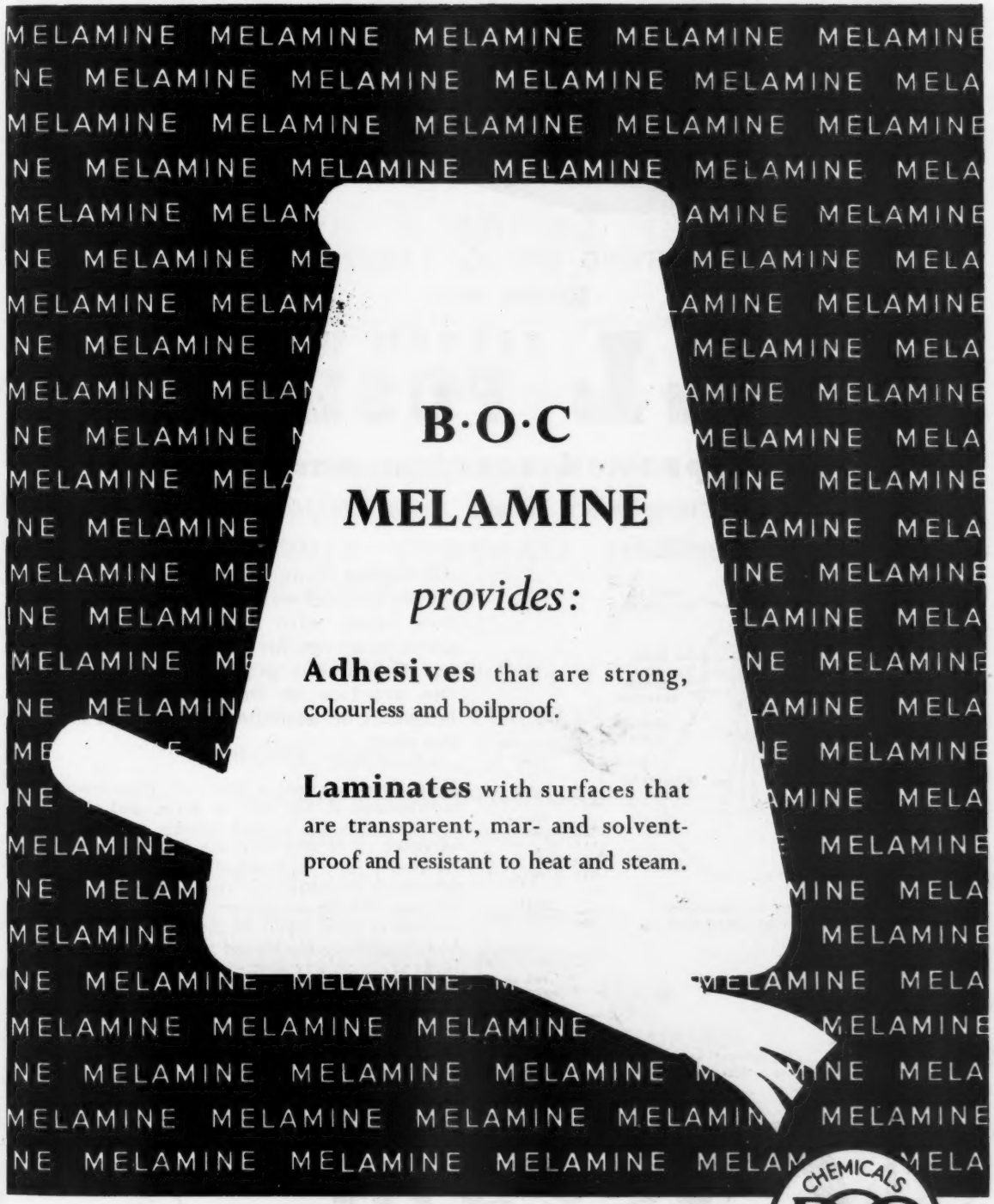
of DESIGN, SERVICE and PERFORMANCE *in* **RUBBER AND PLASTICS MACHINERY**

The Bridge — Banbury Patent Mixer. (1)

4½" Cold Feed Plastics Extruder. (3)

Precision Calender with four superimposed rollers. Flood lubrication. (2)

High temperature 22" x 60 Plastics Mill with flood lubrication. (4)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MELAMINE
provides:
Adhesives that are strong, colourless and boilproof.
Laminates with surfaces that are transparent, mar- and solvent-proof and resistant to heat and steam.

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CHEMICALS DIVISION

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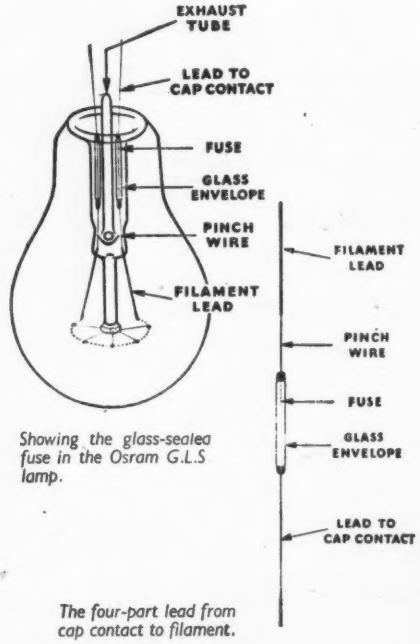
Osram

GENERAL LIGHTING SERVICE LAMPS 40w. – 300w.
200/260 volts

ALL FITTED WITH FUSES

For improved service and safety



Showing the glass-sealed fuse in the Osram G.L.S lamp.

The four-part lead from cap contact to filament.

All Osram General Lighting Service lamps from 40 watts to 300 watts are now fitted with fuses. Introduced some years ago for coiled coil lamps, the G.E.C. has gradually extended the practice to include *single coil* lamps as an additional safeguard to the user.

These fuses are sealed into tiny glass tubes incorporated in the lead in wires, and they rupture when the normal running current is exceeded (as it may be if the filament breaks while the lamp is switched on). This extra protection minimises the risk of circuit fuses blowing and the consequent inconvenience if this causes other lamps on the same circuit to be extinguished. The life and performance of the lamps are in no way affected by the fuses.

Play safe—and specify Osram lamps—they cost no more than other lamps without fuses.

Osram

A G.E.C. PRODUCT

Always in the forefront of lamp development

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

ITALY

Exclusive Agencies Required

Large and well-established Italian house who are already agents for one of the largest British chemical concerns, are prepared to accept further agencies for Italy in the plastics and allied fields.

THE ADVERTISERS REQUIRE TO WORK ON THEIR OWN ACCOUNT NOT ON A COMMISSION BASIS AND WOULD PURCHASE IMMEDIATELY ADEQUATE STOCKS.

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BUTTON MANUFACTURERS
INTERIOR DECORATORS
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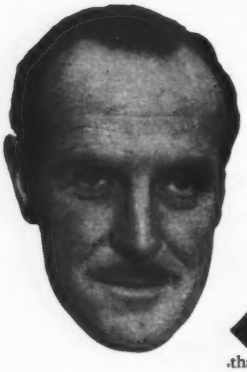
Etc.

To speed negotiations replies to this advertisement will be dealt with initially by the Company's English correspondent in the strictest confidence.

Replies to **Box No. P861** c/o **"Plastics"**
Bowling Green Lane
LONDON, E.C.1

4 people

with different reasons for preferring T & N corrugated containers



THE BUYER

"I have to buy containers that satisfy my three colleagues and many others besides. From T & N I've learned to expect good service, prompt delivery, good quality and ingenious design. And all at fair prices too. They are always ready to advise us about our packaging problems."

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"I can double output and cut down packing room costs by using containers from T & N. Packing *or* unpacking is so easy; no straw or shavings are necessary. Each container has fittings 'tailor-made' for its particular job. Containers and fittings collapse flat for economic storage."

THE ACCOUNTANT

"Because T & N packs are so light they cut down freight costs. Because they are very strong they reduce the risk of damage and loss by pilfering. So you see, we get better returns all round by going to T & N."

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"Customers are always attracted by T & N containers—and they certainly do full justice to the product. T & N design packs in colour to harmonize with their contents and to carry our advertising messages attractively printed on them."

Take advantage of the T & N Advisory Service

May we help to improve your containers or method of packaging? Our experience and expert knowledge is at your disposal—entirely without obligation of course.

THOMPSON & NORRIS

Pioneers of Corrugated Packaging

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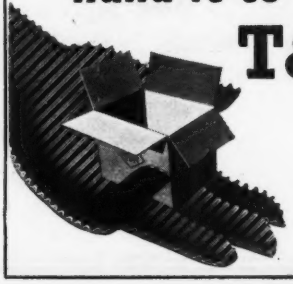
For Corrugated Packaging

hand it to—

T&N



THIS IS JUST WHAT WE'VE BEEN LOOKING FOR . . . AND IN OUR THICKNESS, TOO !
YES, SIR, IT'S EASY TO HANDLE AND ECONOMICAL
'Cellastine'
ACETATE
Sheeting
FOR HIGH-SPEED FORMING AND BLANKING

'Cellastine' sheeting is supplied in continuous lengths

Standard rolls 25″ wide or cut-to-width reels to order.

Less cost, less waste, less handling, less storage space.

Easily fabricated; takes colour-printing.

Present range of thicknesses: 5/1,000″ to 40/1,000″.

In black, white, clear and colours.

Write or telephone for impartial advice about the applications of 'Cellastine' sheeting.

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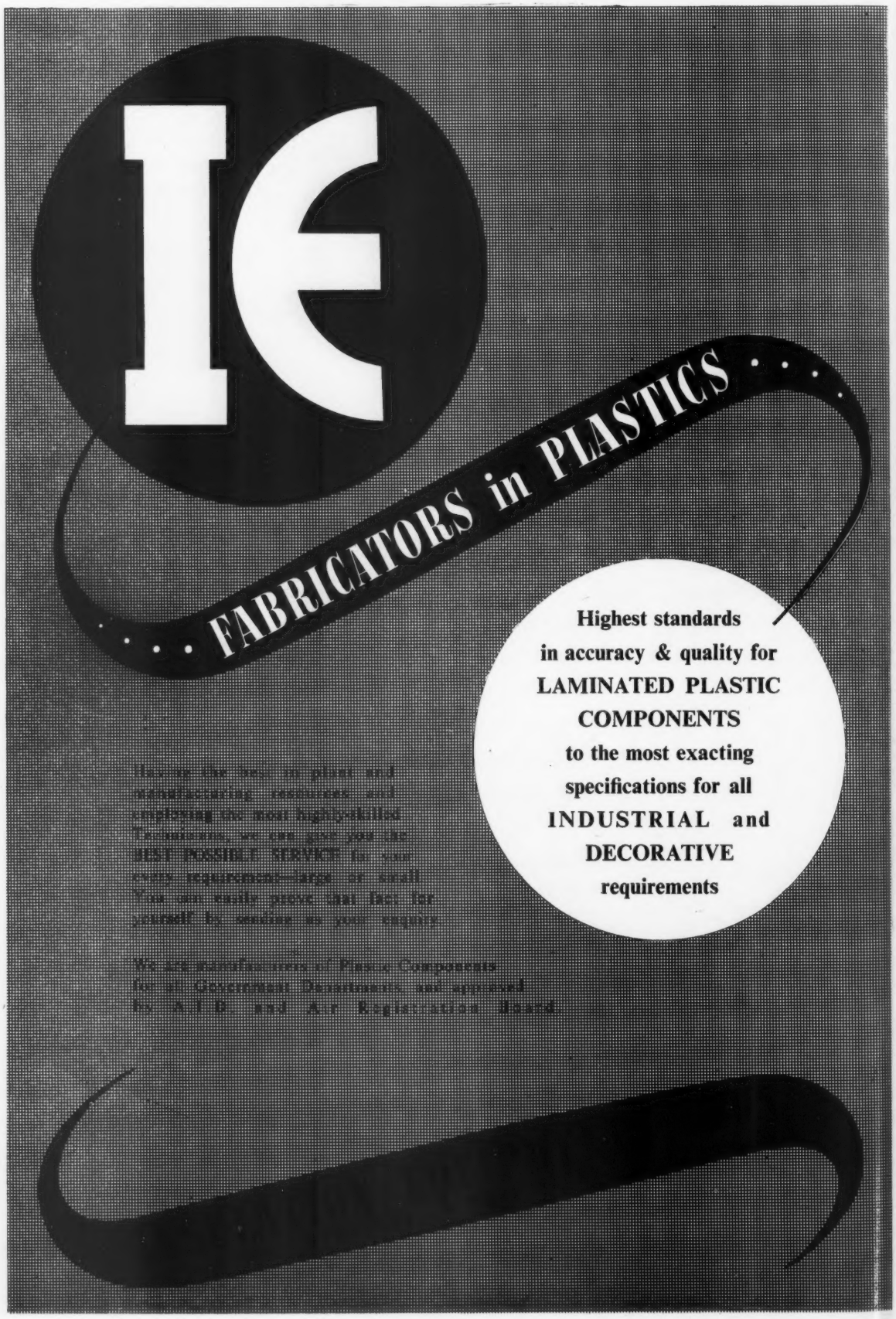
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FABRICATORS in PLASTICS
Highest standards
in accuracy & quality for
LAMINATED PLASTIC
COMPONENTS
to the most exacting
specifications for all
INDUSTRIAL and
DECORATIVE
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facts that speak for themselves

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SHOTS *per* WEEK

8-impression moulding in polythene, of automobile number plate digits and letters. Mould designed and mouldings produced by the Mentmore Manufacturing Co. Ltd. in conjunction with Hills (Patents) Ltd. under Patents Nos 661276 and 661354.

PECO 8/10 OZ. INJECTION MOULDING MACHINE

PECO PRODUCTS

THE PROJECTILE & ENGINEERING COMPANY LTD.

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STYRON

Produced by

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POLYSTYRENE

Produced in

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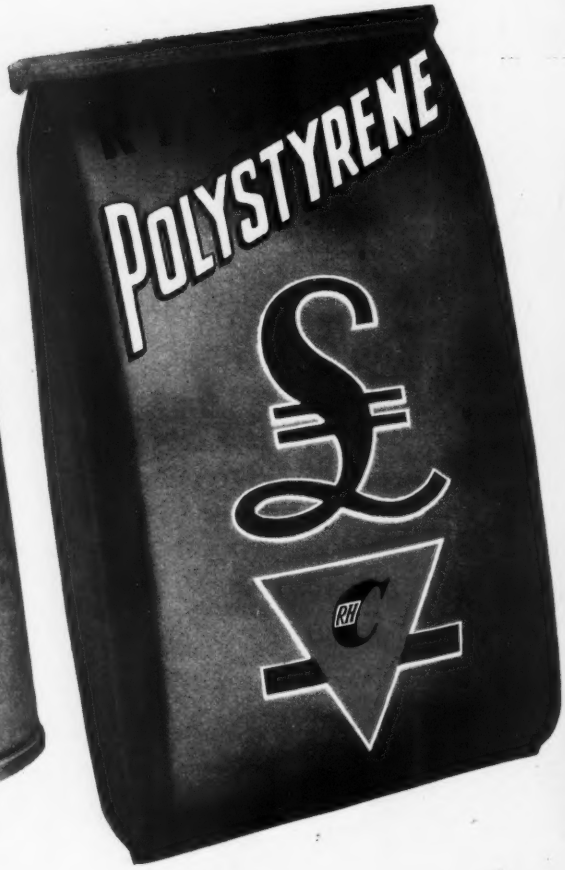

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777 Medium Impact
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POWERFUL

¾ h.p. universal voltage AC/DC motor.

SPEEDY

Full load spindle speed 10,000 r.p.m.; no load 20,000 r.p.m.

VERSATILE

No job too intricate. Grooves, moulds, routs, rabbets in plastics, wood and metal alloys.

THE POWER ROUTER THAT GIVES YOU EVERYTHING

CLEAN CUTTING

No rough edges; no cleaning-up necessary! Finished work in *one* operation.

ADJUSTABLE

Simple depth-of-cut adjustment; cutters changed in 3 minutes.

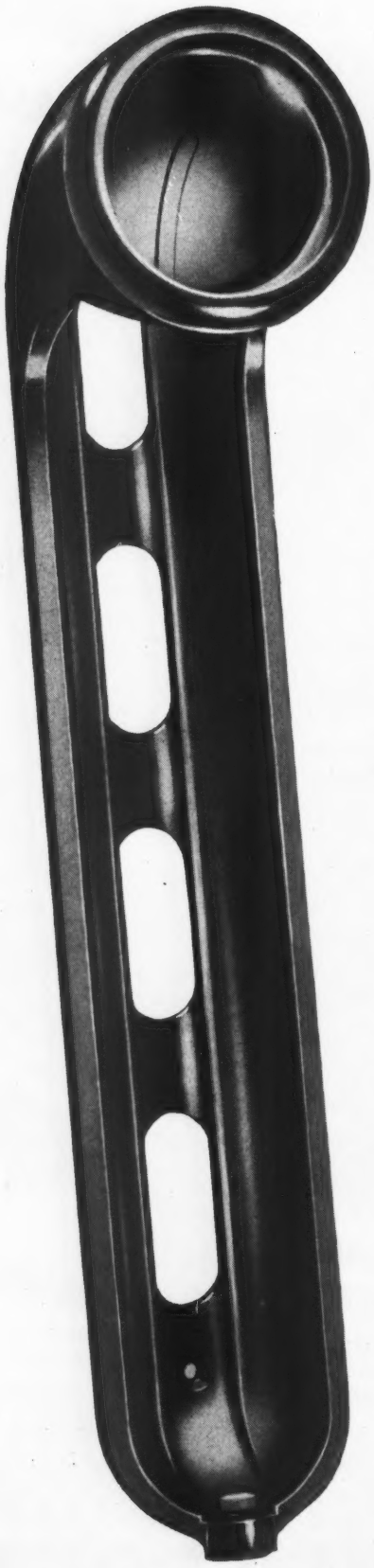
Bridges OF LONDON

PORTABLE ELECTRIC

POWER ROUTER

If your work entails Grooving, Moulding, Routing, or Rabbeting on plastics, you owe it to yourself to write for fully descriptive illustrated folder.

BRIDGES & CO. LTD., 10, BRIDGES PLACE, PARSONS GREEN LANE, LONDON, S.W.6. (RENOWN 1177(8)



They're lively lads at Lorival

You wonder whether something can be moulded? Or you're convinced that it can't be? Ask Lorival. They'll do it if it is at all practicable. Moreover, they'll do it with unsurpassed polish. And their service is first-rate: pleasing design, keen prices, and rapid delivery. Leave it to Lorival.

In this case EBONITE was selected as the most suitable material for this Billiards Pocket for E. J. Riley Ltd., because of its strength and shock-resisting qualities. Original tool design enables the pocket to be moulded in one piece, including the undercut ring and elbow. Soft rubber strips on the bend of the elbow, and a soft rubber pad at the end of the channel section minimise noise in service.

LORIVAL PLASTICS

UNITED EBONITE & LORIVAL LTD.,
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★ Why should you choose 'Cintel' Metal Detecting Equipment?

HERE ARE JUST THREE OF THE MANY REASONS—

★ **CINEMA - TELEVISION** can justly claim to be the pioneers and leaders in the field of Metal Detection in this country. Their practical experience is unrivalled.

★ **CINEMA - TELEVISION** equipment is the first choice of important concerns the world over. Manufacturers renowned for the quality and purity of their products dare not risk their reputations by using anything less than the best.

★ **CINEMA - TELEVISION** prices are the lowest possible compatible with the quality of materials used plus the unrivalled technical skill and practical "know-how" employed.

WHAT "CINTEL" HAS ACHIEVED

1948 First Electronic Metal Detector in this country.
1949 First electrically screened Search Heads.
1950 First Detector with *equal* sensitivity to all metals.
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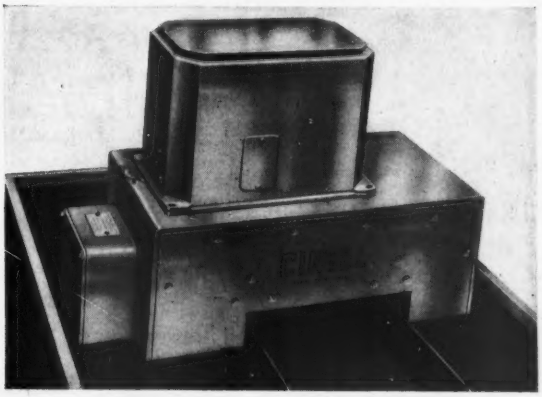
1952 First Miniaturised Multi-Channel Detector.
1953 And now our latest equipment recently shown for the first time at the Packaging Exhibition, Olympia.

You cannot get 'CINTEL' Quality and Efficiency at less than 'CINTEL' price



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A Company within the J. Arthur Rank Organisation

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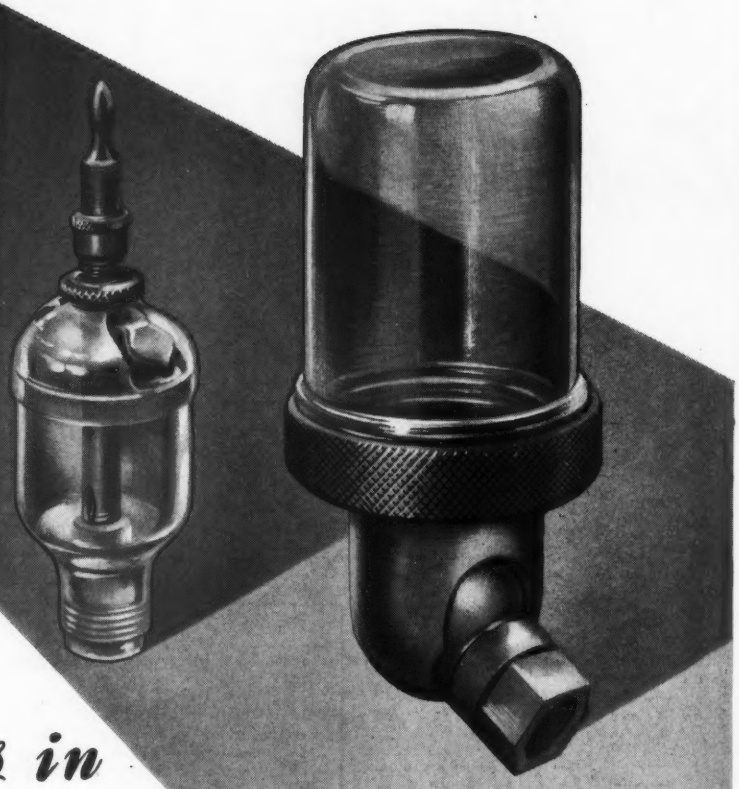
CINTEL

REGISTERED TRADE MARK

P & B
INJECTION MOULDING
Specialists

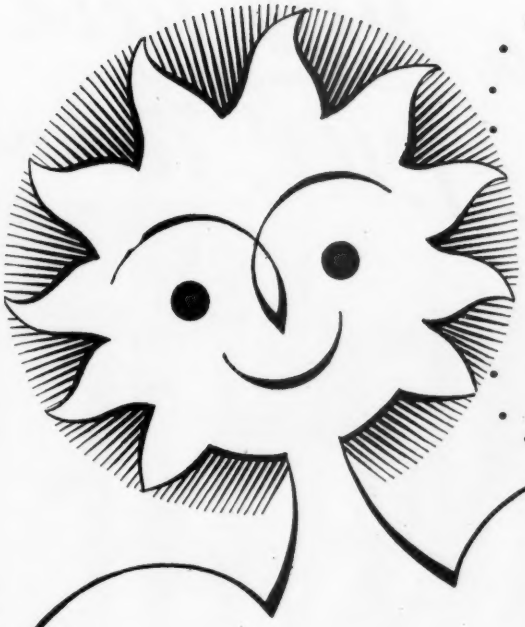


Oil reservoirs in

DIAKON

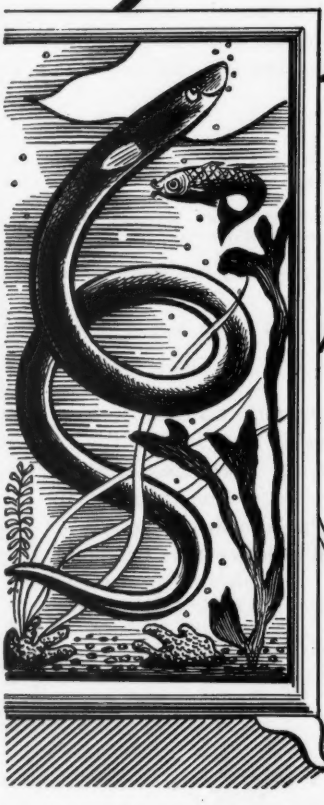
Oil Reservoir in DIAKON, manufactured for, and shown by courtesy of, Messrs. Kingfisher, Limited. We shall be showing a wide range of injection mouldings in all thermoplastic materials on our stand at the British Plastics Exhibition in June.

PUNFIELD & BARSTOW *(Mouldings) Ltd.*
BASIL WORKS, WESTMORELAND ROAD, QUEENSBURY, LONDON, N.W.9
Telephone: COLINDALE 7160 & 7956 Telegrams: PUNFIBARS, HYDE, LONDON



I, too, am unusually flexible!

Gas has claims to be the most generally versatile and flexible fuel known to man. There is almost no limit to the variety of gas-fired equipment and appliances either available or designable. For jobs big or little, straightforward or intricate, flow-production or 'one-off', gas nearly always turns out to be the simplest to install, the easiest to maintain and the most economical to operate. There's no handier man at a heating job than Mr. Therm.



MR. THERM HELPS IN PLASTICS MANUFACTURE

He makes himself very useful in platen heating, heating mixing machines and moulds, preheating powders before moulding and the curing of vulcanised products.

Mr. Therm burns to serve you · THE GAS COUNCIL · 1 GROSVENOR PLACE · LONDON · SW1

Opening a NEW field in P.V.C. Technology:

"VINAGEL"

. . . a series of P.V.C. compounds providing NEW and more economical techniques in calendering, moulding, embossing, extruding, stamping, cold-dipping, etc.

"VINAGEL" is a new material based on Polyvinyl Chloride, with the characteristics of putty for hand-modelling and low pressure processing, or having the consistency of low viscosity paste for cold-dipping. It retains its shape without the use of moulds or other expensive processing equipment during the heat treatment at temperatures of 150° - 170° C.

- **Can be extruded, calendered, coated, stamped and moulded on low-pressure cold processing machinery prior to fusion.**
- **After fusion forms tough resilient products which withstand high temperatures in normal use without deformation.**
- **Can be used for cold-dipping without pre-heating the object to be dipped.**
- **Can be shaped on clay or pottery plant before heat treatment without the aid of moulds or cases.**

OTHER APPLICATIONS of this amazing material include Prototypes and models, Gaskets, Packing Glands and Rings, Conveyor Belts, Tiles and Floor Coverings; permanent flexible Moulds for plaster, cement and cast resins; impression Moulds from ornaments and decorations, hard or flexible articles such as Toys, Display components, protection of metal articles by cold-dipping.

There appears no limit to the ultimate possibilities of "VINAGEL". We shall be pleased to provide experimental quantities in a variety of grades and colours according to the nature of your requirements. Tell us your problem and we will advise you on the use of "VINAGEL".

V.P. VINYL PRODUCTS LTD.

VINYL PRODUCTS LIMITED

(Dept. V.G.) **BUTTER HILL, CARSHALTON, SURREY**

VGI

TEL: WALLINGTON 9282

These new Shell products have many important applications in Industry.

For example: as SOLVENTS in the manufacture of lacquers, plastics, leathercloth and polishes; as CLEANING AND DEHYDRATING AGENTS in the photographic printing and electroplating trades.

I.P.S.1 specification

PURITY : 99% Isopropyl Alcohol by weight.
SPECIFIC GRAVITY at 20°/20°C : 0.785-0.790.
COLOUR : Water White.
DISTILLATION RANGE (A.S.T.M. D268): Minimum 95%, 81-83°C.
NON-VOLATILE MATTER : Maximum 0.01% weight.

I.P.S.2 specification

PURITY: Minimum 85% Isopropyl Alcohol by weight.
SPECIFIC GRAVITY at 20°/20°C: 0.815-0.820.
COLOUR : Water White.
DISTILLATION RANGE (A.S.T.M. D268): Minimum 95%, 78-81°C.
NON-VOLATILE MATTER : Maximum 0.01% weight.

SHELL

Shell Chemicals Limited, Norman House, 105-109 Strand, London, W.C.2. Tel: Temple Bar 4455
(DISTRIBUTORS)

Divisional Offices: Walter House, Bedford Street, London, W.C.2. *Tel.:* Temple Bar 4455. 42 Deansgate, Manchester, 3 *Tel:* Deansgate 6451. Clarence Chambers, 39 Corporation Street, Birmingham, 2. *Tel:* Midland 6954. 28 St. Enoch Square, Glasgow, C.1. *Tel:* Glasgow Central 9561. 53 Middle Abbey Street, Dublin. *Tel:* Dublin 45775. A.3

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Electrify production—

use G.E.C.

ELECTRIC Process Heating

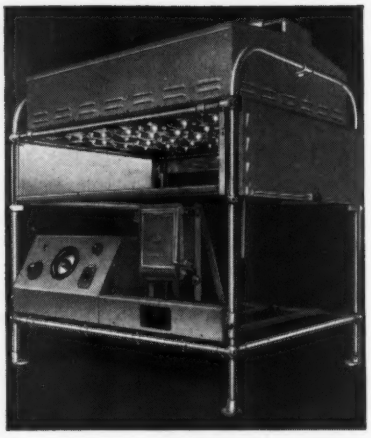
FURNACES · INFRA RED · HIGH FREQUENCY

● Bold thinking about bigger production demands new methods of heat treatment. G.E.C. *electric* process heating ensures maximum output and true economy. The many heating equipments in its range are clean, safe, simple to operate, and heat rapidly to constant correct and controlled temperatures. Its versatility is being proved every day.

● It has unlimited applications: from glue-setting in a wood-working firm to bright annealing in heavy industry. For example, in the Plastics industry it is widely used for thermoplastic materials, thermosetting, gellation or fusing of plastic coated fabrics, and numerous other processes.

● G.E.C. has had many years' experience in the design and construction of heating plant. The Company's specialists welcome opportunities to discuss potential uses.

Infra-Red Heating



G.E.C. INFRA-RED LAMP PLANT can soften thermoplastic sheet prior to shaping very quickly. Because plastic sheet is semi-transparent to the radiation from lamp sources, an adequate uniform softening throughout the sheet is obtained. There is no risk of the material becoming contaminated or marked. There is no "bubbling" at the surface. Heating times vary from 2 to 6 minutes, depending on the thickness of the sheet.

● ELECTRICITY ENSURES TRUE COAL ECONOMY

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

POLYMON COLOURS

comprise a new range, specially prepared for the colouring of plastics

which are now available.

They are particularly suited to all types of thermoplastics, except p.v.c.

Polymon Colours are finely ground powders

with excellent dispersion properties and adequate heat stability.

They can be used to produce bright, transparent colours,

or opaque effects can be obtained by adding white pigments.

For further information please apply to :

IMPERIAL CHEMICAL INDUSTRIES LTD.. LONDON, S.W.1

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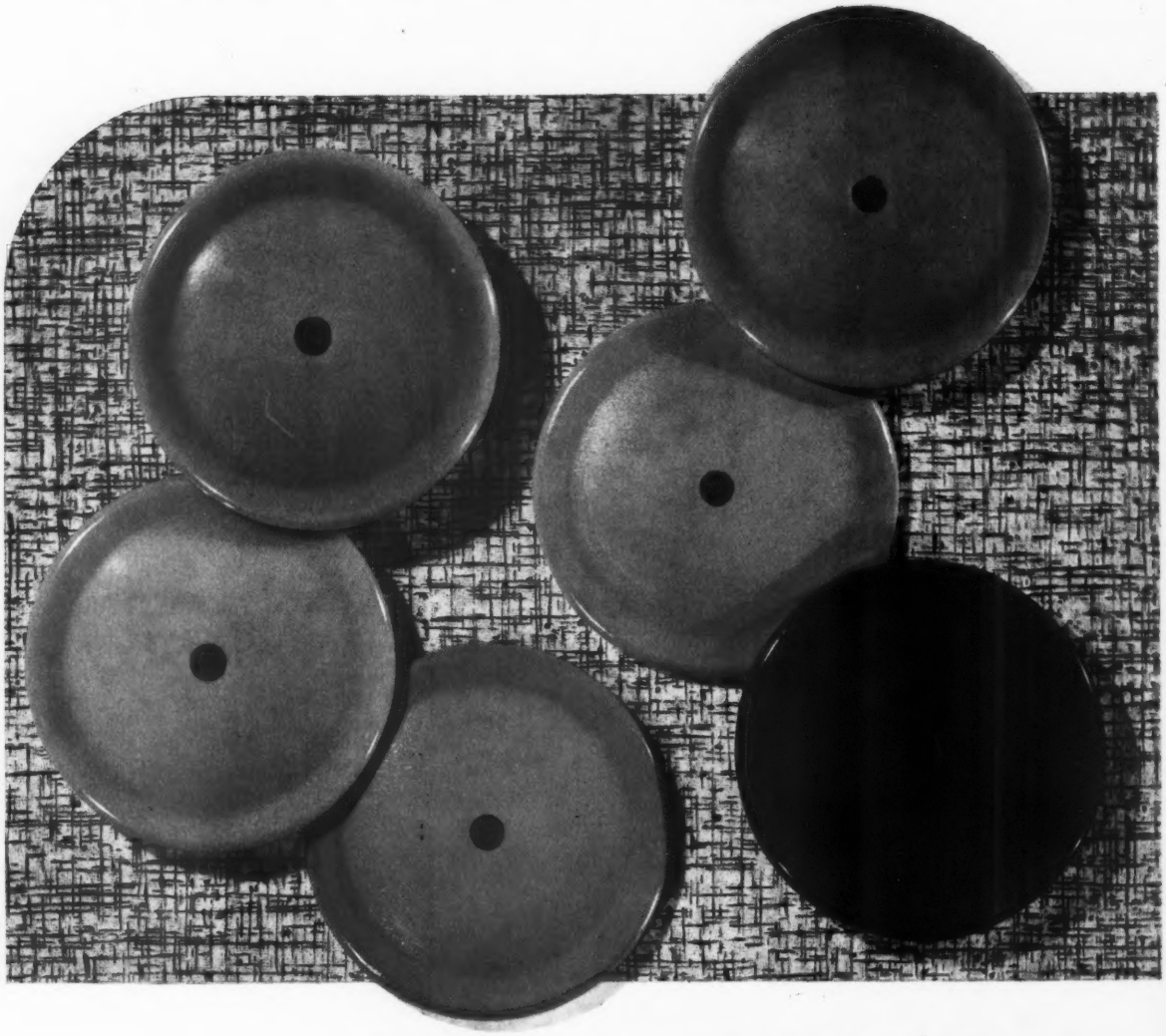
P.56

Coloured Urea MOULDING MATERIALS



Additions to BAKELITE range

Six attractive new colours have just been added to the range of BAKELITE Urea Moulding materials. Red, pink, amber, yellow, green and blue materials are now available in addition to white and cream. Immediate delivery can be obtained by writing or ringing any of our Sales Offices. Please ask for samples and a set of moulded colour patterns.

TREFOIL

BAKELITE PLASTICS

(REGD. TRADE MARKS)

Sales Offices: LONDON, Sloane 0898; BIRMINGHAM Midland, 5911/4; MANCHESTER, Blackfriars 5174/7; GLASGOW, City 6825; or write to:

BAKELITE LIMITED

12-18 GROSVENOR GARDENS · LONDON · SW1

PUT MORE COLOUR INTO IT! · SEND FOR YOUR SAMPLES NOW

Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

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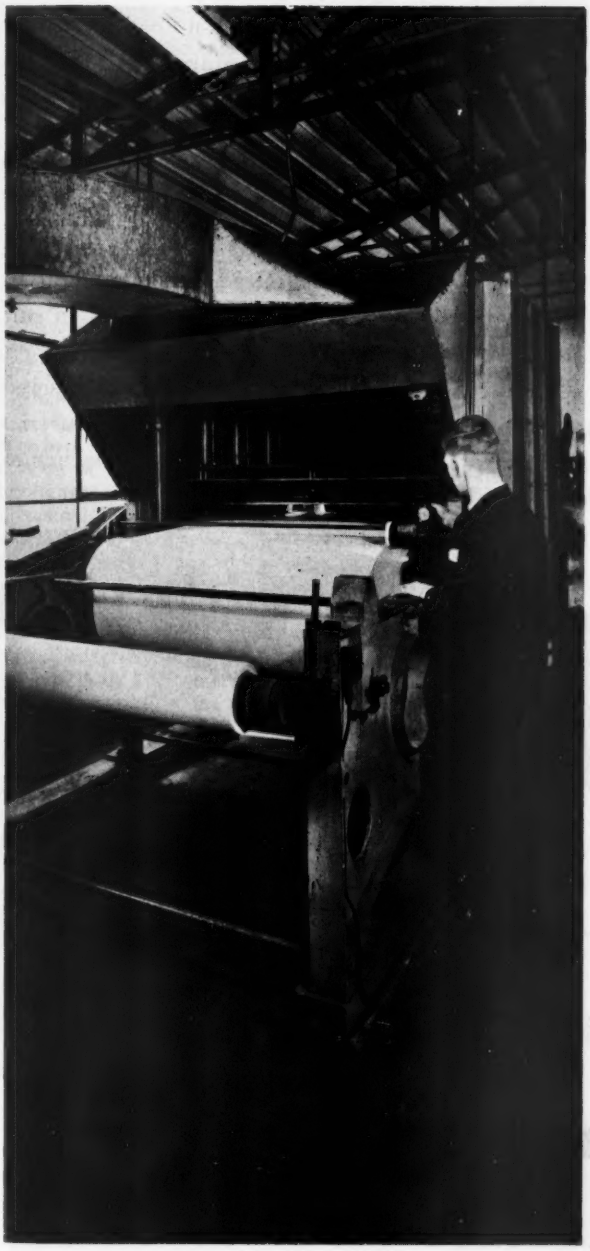

CONTENTS

	Page
Editorials	33
Moulding Powder and Shot	34
Mechanized Production of Foundry Shell Moulds	35
Cellulose Acetate Butyrate—III, by E. E. Halls	38
High Acetyl Cellulose Acetate	39
Polystyrene Emulsion Paints	40
Plastics in the Service of Man	42
National Packaging Exhibition	46
World's Industry Employs Plastics ..	50
Coronation Souvenirs	51
Plastics Research in Holland	52
Improved Injection Moulding Equipment	54
Developments in High-speed Automatic Moulding Machinery, by F. C. Means ..	56
New Productions	58
Letters to the Editor	60
Production News	61
Factors Affecting the High-Speed Tapping of Plastics, by W. M. Halliday ..	64
Patent Review	67

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Curing p.v.c. coating on fabric base at the works of Vinyl Products Ltd., employs infra-red element projectors (operating at source temperature of 750 degrees C.) developed by Metropolitan-Vickers Electrical Co. Ltd., Manchester.

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Plastics

VOL. XVIII. No. 187 FEBRUARY, 1953

EDITORIALS

1952—And All That

THE British plastics industry has had its most difficult year in its history; it was a year to which we had all looked forward with the greatest of confidence, since technologically speaking, it proved to be the brightest.

The industry had to face a sudden change from a seller's market to a buyer's market (as did, indeed, almost all other sections of industry manufacturing consumer goods ranging from textiles to motorcars, furniture, paint manufacture, etc.) under conditions of severe overstocking—a change which became a strong resistance to buy anything but the barest necessities, and which was clearly due to the steadily rising cost of living. During the same period, two countries, Australia and New Zealand, which may be counted as our best sterling customers, suffered even more sudden and severer depression following a period of exceptional success in wool production and sales, coupled also with heavy stock-piling in high-cost consumer goods.

What is so unfortunate and so exasperating is that these conditions arose at a time when, at great cost and energy, the raw material producers were fulfilling their courageous plans of 1949 of expanding greatly their existing plant for the production of the conventional plastics and also new plant for the manufacture of new materials. Whereas our capacity to produce in 1949 was 185,000 tons, it must by now have risen to a figure of the order of 250,000 tons, no mean feat in years of shortage of special steels and other equipment. Such expansion was also paralleled by the moulders and fabricators generally, who increased their press-capacity and other plant accordingly. The energy and capacity of the engineering branch of the industry was noted for the production of a great number of machines for wide world demand.

All branches of the plastics industry, with the exception of a few specialist divisions to which we shall refer later, were affected adversely, and almost all had overstocked during the previous year, and while stocks are being used up and the immediate future in the use of phenolics, ureas, polythene, p.v.c. and polystyrene seems brighter, the position of cellulose acetate moulding has scarcely improved at all.

Of great significance is the fact that, for the first time in its existence, the largest and oldest customer of our industry, the electrical industry, has been forced to curtail its purchases. One of the many causes of the depression that annoys, indeed angers, us, more than another refers to those instances in which purchase tax bears unfairly on what in our stage of civilization—an age of improved health, of hygiene and of relief from heavy household work—must be called essential goods. As examples, we may name many electrical goods as essential as electric light: heaters, cookers, irons, vacuum cleaners, refrigerators and washing machines on which the incidence of purchase tax has been brutally heavy and by no means entirely unconnected with the country's inability to raise sufficient coal to satisfy our needs for power.

The Bright Side

ON the other hand, there has never been such a year of technical movement and improvement—almost every month brought a " high-light " which made exciting reading.

From the raw-material point of view, phenolic and urea resin production increased with the introduction of more efficient plant of the " automatic " or " semi-automatic " type; another manufacturer began production of p.v.c.; the manufacture of polythene increased greatly, as has cellulose acetate, while high acetyl cellulose acetate, which may be regarded as Britain's answer to America's cellulose acetate butyrate, has been found eminently satisfactory for many special exigent purposes; melamine-formaldehyde resins and moulding powders, including the high-density quality, are now being produced in significant quantities; high-impact polystyrene appeared on the British market; four new manufacturers of " low-pressure " polyester resins began operations, two manufacturers produced epoxy resins, and Terylene, which is as yet unknown to the general public as a fibre, came into the orbit of the plastics industry as a new film of special interest to the electrical industry. There is also much promise in the publicity given to the rubber-modified phenolics because of improved impact strengths.

So far as applications in the use of synthetic resins is concerned, the most important are those that are, in fact, expansions of already well-known materials into new fields following prolonged testing, since such entries confirm our known convictions and strengthen the economic basis of the whole industry. Highest on the list we put both p.v.c. and polythene, the first because it has been tested and approved by the Admiralty and by the fishing industry for the production of foul-weather clothing and by the National Coal Board for the production of coal conveyor belts in mines; these belts will eventually replace all underground rubber conveyors. The expansion of polythene in several fields is also most heartening. Its high acid resistance had made its advent welcome to the chemical industry, where it had been used as tanks, pails, valves, stop-cocks and piping for some six years or more: the great promise of the immediate future is a water-piping for the vast industry of agriculture and as drainage systems (using 12-in. extruded piping) for chemical and other acidic or alkaline effluents; the effect of certain compounds (for example, of an apparently harmless material like sodium sulphate) on concrete main drainage raises hopes of the use of polythene in many industrial areas. Another vast field that has opened still wider during the past year is that of packaging, where some four to six additional companies are producing lay-flat tubing by extrusion and blowing (up to 72 ins. circumference), whilst such combinations as polythene-paper laminates are also being produced.

The widest publicity of all plastic materials was given to the glass-fibre reinforcements of resins which, during the past four or five years, have been winning high-strength medals as radomes, hot-air ducts and, indeed, structural units for aircraft, including the Comet and many operational aircraft for the R.A.F. What is significant about this section of the industry is the rapidity of its growth during the past year or so, as translated by the greatly increased number of companies in actual production or carrying out experimental work. While most of the initial work and production had been confined to a very few companies in the plastics industry, some of the aircraft concerns, and a very few completely

outside the industry such as fishing-rod manufacturers and boat builders, the new craft has attracted many new names, the strength and resistant properties of the structures and the relative ease of fabrication and simplicity of cheap moulds having proved the magnet. The most recent industry to be attracted is the motorcar industry, and a few bodies have been made for cars of the racing type. Bonnets, tops and wings have been made experimentally by several workers, but it is early yet to foretell a major upheaval in the motorcar industry. On the other hand, the fact that metal dies for a bonnet top costs something of the order of £1,500-£2,000, while the formers for producing the glass-fibre/resin structure would be about £30, will doubtless give rise to much thought. What is, perhaps, more important is the work being carried out on the production of preforms (we described one machine in our January issue), and the recent news we have received from one of our best-known press manufacturers, to the effect that production of a prototype press specifically for making glass-fibre resin mouldings, has already begun.

As for new plant, our special section "Machines for the Industry" in 1952 showed that there had been no let up in the production of new designs and more especially of machines of increased capacity in the injection type. The recent installation of a number of 60- and 70-oz. machines to tackle yet larger mouldings indicates the certainty of the imminence of new fields of application. On the other hand, perhaps the most welcome news is that of the production of the Dowding fast-cycling injection moulding machine; its specifications indicate that it fulfils hopes for really fast production and places in our hands a tool of considerable importance in our economy. Capable of plasticizing 22 lb. of moulding material per hour it is fully automatic, with a machine cycle speed of up to 1,200 per hour. The maximum weight of moulding per shot is 2 oz.

Plastics Research in Holland

WE publish in this issue a staff report on the Plastics Research Institute T.N.O. at Delft, an organization created during the post-war period. To-day, with the loss of much of its overseas resources in the East, including rubber and petroleum, it appears that Holland is determined to sell her skill in science and technology and doubtless T.N.O. is one of the tools with which this will be done. We, with vastly greater resources, and with superb chemical and petroleum refineries behind us, have not yet seriously considered the urgency of creating a scientific and technical research organization for an industry that already exerts an enormous influence on the direction taken by the organic chemical industries of the world.

Moulding Powder and Shot

Advice to Fakers

The lot of the forger of old paintings is no happy one nowadays; they don't seem to have much chance once the paintings are examined by a chemist or physicist who knows his stuff. I believe the trouble is that painters know so little about paint. I should imagine that if they went through a decent course at any polytechnic they'd get away with their efforts much more easily. Dr. A. E. A. Werner, research chemist at the National Gallery, has been giving lectures on this subject and on the examination of paintings, before the Institute of Chemistry, and relates how the forgeries of Van Meegeren (it will be remembered that his speciality was the faking of Vermeers) were shown to be of modern origin. Among other things it was found that in trying to produce the essential hard and solvent-resisting paint he used a phenol-formaldehyde type which was hardened by subsequent baking—and of course it was very easy to discover this fact. If he had known more about paints he would have known how to produce a hard paint from certain natural resins whose identification would have been extremely difficult. Even so, this wouldn't prevent the discovery of the fake.

* * *

Plastic Boats

The recent release of information from the Admiralty to the effect that the Navy has had built, and is in process of testing, small boats of glass-fibre reinforced synthetic will, I am sure, please those boatbuilders who during the past few years have had the courage to learn the technique and make the prototypes. While talking to one of them at the November Motor Show at Olympia, he told me that very few had been bought in this country, although immense interest had been shown in his own "glass" boat exhibit by many people, including ships' engineers. Successful tests by the Navy will go a long way to convince potential buyers, who are adopting a "wait-and-see" attitude, of their value and indeed of fibre-glass structures in general. I should have thought that there would have been an immediate response from those Dominions and Colonies where wood-rot and attack of worm is so prevalent. Much of the future progress in this field will be in the production of preforms, as described in the January issue of this journal, and in the pressing of large shapes.

Pity the Poor Fireman

There are strange hazards in this world and among them is a type much in the public eye because of the recent Naval expedition to Greenland and other places within the Arctic Circle to carry out personal endurance tests. Our interest lies in the fact that foul-weather clothing made from p.v.c. sheet is now standard in the Navy, and all of us have seen photographs of men wearing special kit jumping into semi-frozen seas. The latter kit may have nothing to do with plastics, but a recent note in a daily newspaper referring to a recent fire in Glasgow stated that the cold was so intense that the water from the hoses soaked the firemen's uniforms, and froze hard to their backs. It all sounds as if a new type of plastic clothing is required here that will be at the same time water- and high-temperature resistant.

* * *

Robert Hartley

Robert Hartley died last month, and with his going I and everybody I know in the industry loses a close friend. It is very many years since he joined the F. A. Hughes Company and so worked for the growth of an organization that is now a major factor in our modern synthetic-resin industry—a group that gave rise to British Resin Products, Ltd., and British Geon, Ltd. He spent most of his working life for the well-being of the industry and more especially of the Plastics Institute to which he was a tower of strength. His very entry into a meeting was a sign that all was well; his beaming Pickwickian face and cheerful spirit, like some magic catalyst, warmed the hearts of all around him. Inevitably, I think of something Gilbert Chesterton wrote about Charles Dickens: "We have a long way to travel before we get back to what Dickens meant: and the passage is along a rambling English road, a twisting road such as Mr. Pickwick travelled. But this at least is part of what he meant; that comradeship and serious joys are not interludes in our travel; but that rather our travels are interludes in comradeship and joy. The inn does not point to the road; the road points to the inn. And all roads point at last to an ultimate inn where we shall meet Dickens and all his characters: and when we drink again it shall be from the great flagons in the tavern at the end of the world." A memorial service to Robert Hartley was held on January 30 at Holy Trinity, Brompton Parish Church, London, S.W.

DOGSBODDY.

Mechanized Production of Foundry Shell Moulds from Resin/Sand Mixtures

IN two of our recent issues of " Plastics " (August, 1952, page 231, and November, 1952, page 333) we have described the recently introduced process of making foundry moulds from shells of sand bonded with a phenolic resin binder. The production in this country of an automatic machine which mechanizes this method of making shell moulds will undoubtedly make this process acceptable by foundries with a large and regular output. The fact that this process can represent—if it is used by foundries to the extent envisaged in some circles—a major outlet for the thermosetting resins employed, is of considerable significance.

The Polygram Casting Co., Ltd., who have been very active in this field and hold a number of patents regarding the techniques employed, estimate that the requirements of resins will be many million pounds in this country alone. Comparing the amount of sand used for conventional and shell mouldings, they point out that 100,000 tons of sand-resin mixture will replace a million tons of normal moulding sand. On the basis of 7 per cent. resin content, this production will require 7,000 tons or 16 million pounds of resin per annum. Depending on the number of British foundries which will eventually take up shell moulding practice when it becomes fully established, these quantities may well be multiplied two-, three-, or four-fold. In this connection it is interesting to quote some estimates for American consumption given by " Modern Plastics " last February. They say that " the potential volume of phenolic resin used in shell moulding may within five or ten years exceed the volume consumed by any other outlet now known for phenolic resins. Currently the largest outlet is phenolic moulding powder, which consumed a little over 100 million lb. of resin a year in 1950 and 1951. A conservative guess would place the amount used for shell moulding in 1951 at 4½ million pounds. In 1952 it may hit 20 million, and it could go higher if certain defence projects are switched to shell moulding technique. Under normal conditions, volume might reach 65 million lb. within two or three years, but any such prediction must be cautiously weighed."

Their estimate on operating figures is as follows: " It may be assumed that about 10 lb. of sand-resin mix is required to produce a 50 lb. iron casting. The amount of resin may vary from 5 to 10 per cent., but tends to the lower quantity. An average figure could thus be approximately 0.0125 lb. of resin for every pound of casting. An automotive or a major farm implement company producing 500,000 tons of castings in a year could thus use over 10 million lb. of resin. At maximum use the figure might be anywhere from 10 to 70 million lb. a year per company. The reader should be cautioned at this point that these are optimum figures for individual concerns and would depend upon each company's degree of conversion."

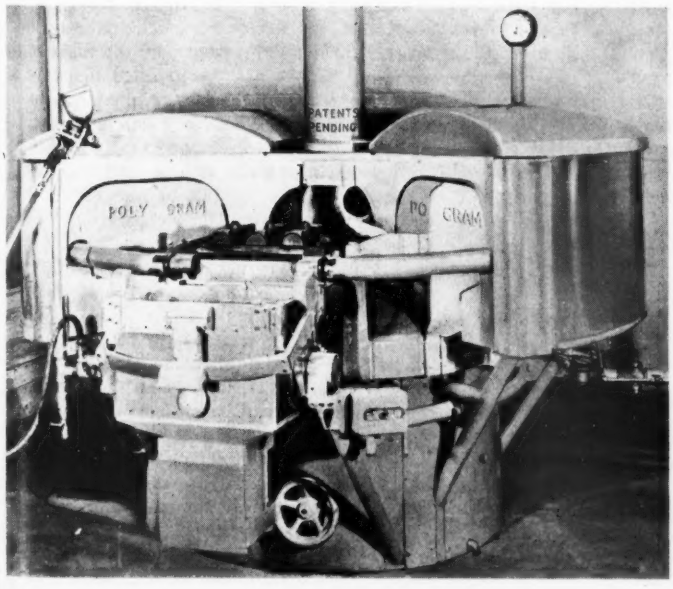


Fig. 1.—Polygram automatic shell moulding machine, Mark IV. In this general view, the bin containing the resin/sand mix is seen in the foreground with one of the four pattern plates in position ready for investment. The gas-heated oven and its entrance and exit tunnels are seen in the background; the spray gun, to the left, serves to apply a parting agent.

Economic Advantages

What is at present uncertain is the proportion of foundry jobs which shell moulding will take over from other methods, and this will depend on economic considerations. Certain factors in the production of shell moulds can lower costs. Overheads—in mechanical handling of large quantities of sand in cleaning and in equipment—are greatly reduced. Labour costs are also lower since making shell moulds is unskilled work, whilst a sand mould maker is a skilled, trained man. Speed of production both by hand and in mechanized equipment also favours the shell moulder. To offset these advantages come the cost of the resin binder and the initial cost of machined steel pattern plates. Even if these factors, when balanced, make for a higher cost per casting, shell moulding may still be preferred because the excellent finish and accuracy are not only desirable features in themselves, but can help considerably to reduce the amount of machining and finishing on the final component—and by that means give a lower overall cost.

Another rival to shell moulding, when the dimensional accuracy of this process is being exploited, is the die-casting process for non-ferrous metals, because a manufacturer might consider the cost of a machined steel pattern plate for shell moulds—which may be in the region of several hundred pounds—is not much less than the cost of a complete die. This will of course vary from job to job and only experienced foundrymen can decide border line cases. Bearing these economic considerations in mind the shell moulding process will be most rapidly taken up by " internal " foundries, i.e., foundries which are part of a larger manufacturing unit such as a car or refrigerator factory. Jobbing foundries working on long repetitive runs will also convert at least part of their production to shell moulding.

Requirements of Resin Binder

Many resin manufacturers in Great Britain, Germany and the United States have developed or are developing resins for binding shell moulds. The basic requirement is for a resin of small particle size (200 mesh) which can be intimately mixed with the sand and which will flow when subjected to the high temperature of the pattern plate. The resin must be fast curing and should have reasonably long storage life. Monsanto Chemical Co., of the United States,

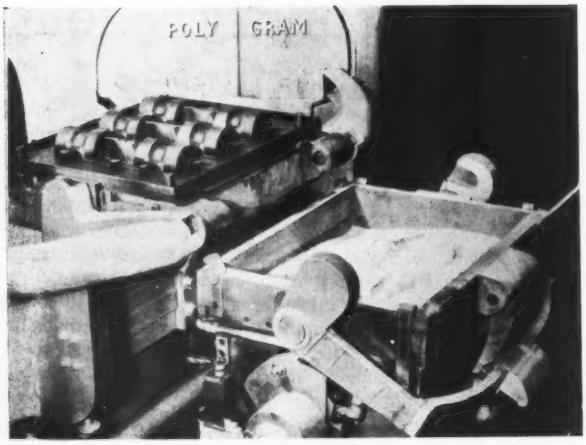


Fig. 2.—First stage in the reproduction of a shell mould is the application of suitable parting agents to facilitate removal of the cured shell from the pattern plate. This view shows the pattern plate (left) and the investment bin.

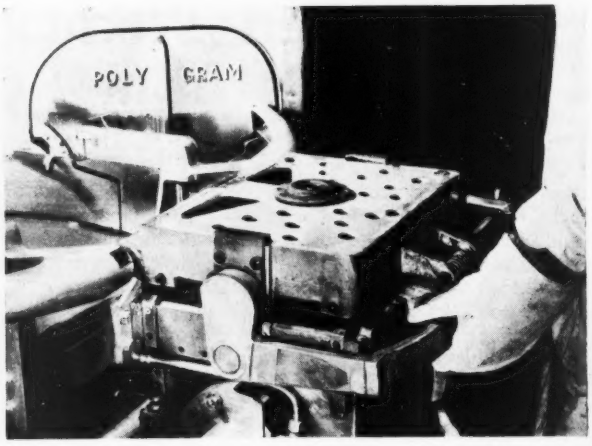


Fig. 3.—The pattern plate is rolled over the mouth of the investment bin and is clamped in position on the Polygram Mark IV machine, this operation, as well as inverting, is manual.

who have done considerable work on shell moulding in the U.S.A., consider that resins which are theoretically suitable include phenol formaldehyde, urea formaldehyde and melamine formaldehyde resins, alkyds and polyester resins. Low temperature setting resins of the two last-named types may change the whole conception of the process if the curing-oven stage can be eliminated.

At the moment, however, only phenolic resins have been seriously considered. These are usually finely powdered novolak or two-stage resins combined with some 8 per cent. of hexamethylene tetramine, intimately mixed after the resin has been ground. This form of resin is very stable if kept in a cool, dry atmosphere to minimize caking. Powder resoles or single-stage resins have also been used, but their storage life is limited. Developments on urea resins indicate that they will probably be suitable for use with non-ferrous metals.

Resins suitable for the shell moulding process are being marketed and manufactured in this country by several resin manufacturers. These include Mouldrite P.F.422, manufactured by Imperial Chemical Industries, Ltd., Plastics Division, and Cellobond J.2453, manufactured by British Resins, Ltd. Bakelite, Ltd., are at present producing three resins, R.0222, R.17336 and R.17437, in addition to wetting and parting agents, specially developed for shell moulds and cores. These three resins are powdered materials ready for mixing with sand. Of the first two, R.0222 can be used at a lower temperature than R.17336, but the latter is based upon lower-priced materials and is fully adequate for many purposes. R.17437 is the latest resin to be developed for the purpose by this company and, whilst being also cheaper than R.0222, is in general equal to it in performance.

New Automatic Machine

All the operations used in the shell-making process can be mechanized by means of specially-designed machines, such as the Polygram Automatic Shell Moulding Machine Mark IV, which is shown in the accompanying illustrations. This machine has a manual rollover of the counter-balanced investment bin. Other designs are, however, available with different bin sizes to suit different pattern plates and a Mark V fully-automatic rollover.

Mechanization removes the actual control of the basic elements from the operator and entrusts them instead to the planned instrumentation of the machine. Thus, the oven temperature is kept accurately constant by means of a thermostat while the cycle time is controlled within limits of ±20 per cent. by means of the variable-speed handwheel at the base of the machine. In the automatic rollover machine, the time of investment can, however, still be set by the operator since this gives the necessary flexibility when four widely different pattern plates are being used on the machine at the same time.

The machine has four stations, at each of which the mould is being worked upon. This means, in effect, that the output is equal to that of four ordinary operators making shell moulds by hand. The mean time for a complete cycle of the machine is 120 secs. During this time, however, no less than four half moulds are produced which is equivalent to an output of 60 complete moulds per hour. This output has been achieved by reducing the indexing time to quarter of the total time, thus giving the maximum effective production time for a given cycle. The pattern plate and "biscuit" shell which is being cured spends no less than three-quarters of the cycle time in the oven so that an adequate curing time is ensured without excessive oven temperature. With an output of one complete mould per minute, for instance, the time in the oven is 1½ mins. which is roughly that used in the hand process. One feature which has cut down the cycle time and increased the quality of the biscuit is the automatic ejection and plate design. All that the operator needs to do is to lift the complete biscuit from its raised position on the ejector pins. The pattern plate is then sprayed with stripper and invested with the resin-sand mixture. The operator then swings the invested plate back on to the indexing frame which carries it into the oven. The cycle is normally sufficiently long for a deft operator to have a pause of a few seconds before having to proceed with the next plate. This largely offsets fatigue and enables a figure very close to the nominal output of one mould per minute to be kept up over the complete working day. The oven of the machine may well be started by a time switch at the commencement of the day before the workers arrive and it is then only a matter of dropping the required pattern plates into their carriers and running the machine for about 8 to 10 complete cycles before it is ready for operation.

The Mark IV automatic moulding machine has a 6-ft. 6-in. overall diameter and a height of 4 ft. 3 ins. to the crown of the oven dome. Mains supplies can be brought up under the base of the machine so as to give a free floor space right round the machine, thus rendering sweeping and maintenance both extremely easy. This cleanliness is much assisted by the complete absence of any deposition of the resin-sand mixture on to the floor when the bin is inverted.

The mechanism is readily accessible. The gearbox, together with a robust and accurately manufactured mechanism have

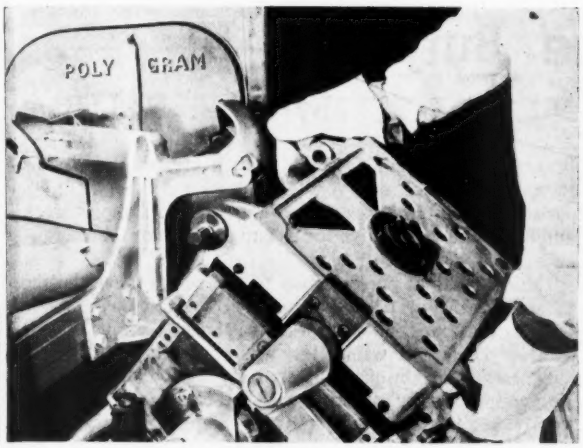


Fig. 4.—The whole bin with the heated pattern plate is inverted. In a short time a resin/sand shell is built up to about ¼-in. thickness, bonded by the molten resin.

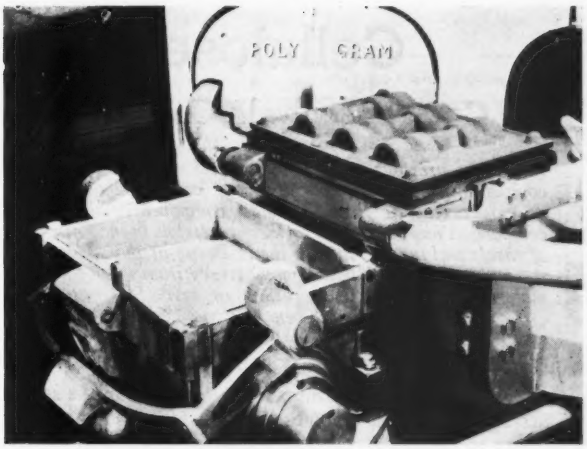


Fig. 5.—The sand shell on the pattern plate is returned to its original position, passes through the three curing oven stages and is finally raised from the pattern by means of ejector pins.

been designed so that the machine can withstand the most arduous foundry conditions. The ejector system is the outcome of many experiments which have resulted in a most successful positive ejection. The only attention which should be required is a brief periodic maintenance check-over each week and a slightly more extensive one at longer intervals. Should a pattern plate be defective, moreover, it can be dismounted in a matter of seconds and replaced by a good one without affecting the machine in any way.

The curing oven is gas heated and gas consumption has been kept to a minimum by the careful design of the burners and lagging of the oven as well as by the fitting of a gas governor. Consumption will be at the rate of perhaps 200 cu. ft. in the first 20 minutes while the oven is reaching curing temperature and then at the rate of under 150 cu. ft. per hour for the rest of the day. The action of the governor is such that the temperature of the oven is rapidly returned to the desired point after the indexing mechanism brings in colder materials. After these few seconds the intensity of the gas flow is rapidly lowered since a steady temperature is maintained inside the well-lagged walls.

The machine is driven by a 1 h.p. screen-protected squirrel-cage induction motor which is protected from mechanical overload by a safety clutch on the main shaft drive. Should any mechanical defect occur this clutch will slip before any damage is done and, on the obstruction being removed, the machine will again function perfectly.

A further safety device is incorporated whereby, unless the pattern plate is returned to its carrier before the indexing motion starts, the motor will automatically cut out.

The manufacturers claim that the Polygram Automatic Shell Moulding Machine Mark IV will normally pay for itself in less than a year. An additional advantage is that absolutely consistent moulds are produced which, in turn, give consistent castings. Moreover, the machine sets the pace for the rest of the foundry team so that assembly, pouring, knock-out and separating the risers must all take place in step or a bottle-neck will become obvious. This gives a certainty and uniformity in cost and budgetary control which is unique in the foundry industry. The result is that accurate estimating can be carried out with the minimum of work and this estimate will then be adhered to in the foundry. Finally, the machine can be operated by completely unskilled labour and the actual work involved is clean and not too arduous. This will undoubtedly make recruitment for the foundry industry both simpler and cheaper than it has been in the past.

Fig. 6.—Metal being poured into a group of assembled shell moulds, which are sufficiently small to require no backing. Note the way in which the resin bond ignites in contact with molten metal, thus disintegrating the mould and making removal of castings easy.

Cellulose Acetate Butyrate—III

A Comparison with Cellulose Acetate

By E. E. HALLS

In the two previous parts of this article the author has compared the properties of cellulose acetate with those of cellulose acetate butyrate in moulded components ; also a comparison has been given of these materials in the form of sheets and tubes. In this, the last part of the series, the author deals with films manufactured from these two materials, giving detailed results of tests for water absorption and dimensional stability.

4. Film.

Cellulose acetate butyrate film can be produced in the same colours and patterns as cellulose acetate film. Transparent colourless and coloured varieties are usual, but the common decorative effects obtained by printing, embossing and the like are applicable. Much film has been made and used in the U.S.A., where probably the largest field has been in packaging, for various kinds of wrappers, but it has also been used in photographic and photo-printing processes, as well as an electrical insulating medium, particularly in small coils. Rather better flexibility than is exhibited by acetate makes it attractive in all these applications.

Film material is made in thicknesses from approximately 0.001-in. up to 0.010 in. The same dimensional stability is not to be expected in such thin sheets as is obtained with the thicker sheet or the relatively more massive mouldings and tubings. There is obviously more possibility of evaporation of plasticizer from the mass in the thin gauges, and of easier expulsion by moisture vapour or water and, therefore, there is more chance of dimensional change. The plasticizer content and its nature are important factors. Again, film is usually made from solution by evaporating on rollers, and some solvent is retained. This latter evaporates to give an added chance of shrinkage.

Tables 12, 13 and 14 give stability data on a range of these film materials, and the values must be considered in conjunction with the plasticizer contents given in Table 11.

Table 12 deals with performance under the extended water immersion conditions. The acetate butyrate films all show reasonable stability, and the general trend is an initial absorption followed by a loss as the rate of loss of plasticizer exceeds the gain due to water taken up. The acetates generally exhibit greater changes. Sample 6 is a relatively highly plasticized material, and it shows very large weight losses over the test period, with correspondingly rather high shrinkages. At the same time, the progress of change in this sample under the water immersion conditions is relatively uniform, i.e. progressively a shrinkage or loss. Similar remarks apply to the very highly plasticized acetate film, sample 9, except that the weight loss is very high, and shrinkage in thickness exceedingly great. The highest plasticizer content acetate butyrate film, sample 3, reveals much greater stability than these two acetates, and very good bursting strength in comparison (see Table 11). Of the other acetate samples, Nos. 7 and 8 still show very high losses and contractions, but Nos. 10 and 11 are very much better.

Table 13 shows performance of the same materials under the moderate dry heat exposure of 60 degrees C. Of the acetate butyrates, the highest plasticized sample, No. 3, exhibits the largest weight loss and contractions. Except in thickness, where shrinkage is relatively high, the performances are good, especially in sample 5. Of the acetates, Nos. 10 and 11 are again very good, and the high plasticizer content materials, Nos. 6 and 9, exhibited poorest performance with high contractions and high weight losses. The other two samples of medium plasticization, Nos. 7 and 8, showed an intermediate level of weight loss and contraction, except that No. 7 shrunk excessively in thickness.

Table 14 deals with the fluctuating mild humidity test; the fluctuating values can only be interpreted broadly. The first three acetate butyrate films, Nos. 1 to 3, show appreciable weight and thickness changes, whereas Nos. 4 and 5 which are thicker materials, performed very well. The high plasticized

Table 11.—Plasticizer Contents and Bursting Strengths of Cellulose Acetate and Acetate Butyrate Films.

Sample No.	Material.	Plasticizer Content per cent.	Bursting Strength lbs./sq. in.
1	Cellulose Acetate Butyrate	7.5	65
2	Cellulose Acetate Butyrate	13.5	70
3	Cellulose Acetate Butyrate	20.4	58
4	Cellulose Acetate Butyrate	7 4	107
5	Cellulose Acetate Butyrate	8.7	115
6	Cellulose Acetate	35.0	50
7	Cellulose Acetate	22.5	55
8	Cellulose Acetate	21.7	25
9	Cellulose Acetate	42.0	32
10	Cellulose Acetate	16.3	52
11	Cellulose Acetate	18.5	125

Table 12.—Changes in Dimensions and Weight of Cellulose Acetate and Acetate Butyrate Film under Water Immersion Conditions at 25°C.

Sample No.	Material	Thickness in mils.	Period of Test in days	Parts per Thousand Change in			
				Length	Width	Thickness	Weight
1	Cellulose Acetate Butyrate	2.5	7	−10	−12	+ 40	+ 18
			100	−20	−23	Nil.	− 15
			200	−20	−23	Nil.	− 21
			400	−15	−18	− 40	− 18
2	Cellulose Acetate Butyrate	4.0	7	Nil.	Nil.	+ 60	+ 31
			100	−10	− 6	Nil.	+ 31
			200	− 5	− 6	− 60	+ 27
			400	−10	− 6	+ 30	+ 24
3	Cellulose Acetate Butyrate	2.0	7	− 6	Nil.	Nil.	+ 45
			100	−12	−3.5	− 50	+ 4
			200	−15	−12	− 90	− 15
			400	Nil.	−12	− 90	− 20
4	Cellulose Acetate Butyrate	8.0	7	+11	+11	Nil.	+ 35
			100	Nil.	Nil.	Nil.	+ 40
			200	+ 6	+ 6	− 12	+ 55
			400	+ 6	Nil.	− 12	+ 48
5	Cellulose Acetate Butyrate	9.0	7	Nil.	+ 6	+ 23	+ 28
			100	Nil.	+ 6	+ 11	+ 26
			200	Nil.	+ 6	+ 11	+ 28
			400	+ 6	+ 6	+ 23	+ 26
6	Cellulose Acetate ..	3.5	7	−30	−20	Nil.	− 53
			100	−35	−27	Nil.	−145
			200	−35	−27	Nil.	−160
			400	−45	−33	Nil.	−210
7	Cellulose Acetate ..	2.2	7	−15	−20	−150	− 40
			100	−30	−30	−200	−110
			200	−35	−35	−200	−120
			400	−45	−45	−250	−155
8	Cellulose Acetate ..	1.6	7	−15	−15	Nil.	− 45
			100	−32	−30	− 60	−130
			200	−35	−35	− 60	−135
			400	−42	−45	−120	−148
9	Cellulose Acetate ..	2.5	7	−30	−30	− 40	−181
			100	−35	−30	−200	−193
			200	−40	−40	−200	−220
			400	−50	−50	−240	−245
10	Cellulose Acetate ..	2.0	7	+15	− 7	+ 80	− 45
			100	Nil.	− 7	− 80	− 65
			200	+ 5	− 8	Nil.	− 80
			400	+ 3	Nil.	− 80	− 96
11	Cellulose Acetate ..	7.0	7	+10	+15	+ 15	− 34
			100	+10	+15	Nil.	− 48
			200	+10	+18	+ 30	− 75
			400	+10	+10	Nil.	− 91

Table 13.—Changes in Weight and Dimensions of Cellulose Acetate and Acetate Butyrate Film under Continuous Dry Heat at 60°C.

Sample No.	Material	Thickness in mils.	Period of Test in Days	Parts per Thousand Change in :—			
				Length	Width	Thickness	Weight
1	Cellulose Acetate Butyrate	2.5	7	−12	−10	− 80	− 28
			100	−15	−15	−120	− 45
			200	−20	−15	−160	− 50
			400	−20	−20	− 80	− 50
2	Cellulose Acetate Butyrate	4.0	7	− 5	−12	Nil	+ 5
			100	−10	−12	−100	− 10
			200	−10	−12	−125	− 13
			400	−10	−12	− 25	− 10
3	Cellulose Acetate Butyrate	2.0	7	−22	−23	− 40	− 85
			100	−39	−35	− 80	−125
			200	−44	−35	−120	−132
			400	−39	−35	− 80	−140
4	Cellulose Acetate Butyrate	8.0	7	Nil	Nil	− 12	− 8
			100	Nil	Nil	− 38	− 14
			200	− 6	− 6	− 62	− 14
			400	−12	−12	− 50	− 16
5	Cellulose Acetate Butyrate	9.0	7	Nil	Nil	− 11	− 6
			100	− 5	− 3.5	− 13	− 9
			200	− 5	− 5	− 20	− 9
			400	− 8	− 5	− 20	− 12
6	Cellulose Acetate	3.5	7	− 5	Nil	+ 30	− 27
			100	−20	−20	+ 30	− 90
			200	−30	−27	+ 30	− 96
			400	−45	−40	Nil	−130
7	Cellulose Acetate	2.2	7	−10	−10	−140	− 18
			100	−20	−22	−230	− 60
			200	−22	−25	−230	− 64
			400	−35	−35	−230	− 85
8	Cellulose Acetate	1.6	7	−15	−15	− 60	− 45
			100	−15	−15	− 60	− 56
			200	−23	−20	− 60	− 54
			400	−25	−23	−120	− 74
9	Cellulose Acetate	2.5	7	−20	−20	− 40	− 50
			100	−35	−40	160	−146
			200	−40	−45	−160	−170
			400	−50	−55	−200	−210
10	Cellulose Acetate	2.0	7	− 5	− 5	Nil	− 6
			100	− 5	− 7	Nil	− 24
			200	−10	−20	+ 45	− 28
			400	−20	−20	+ 45	− 34
11	Cellulose Acetate	7.0	7	− 3	Nil	Nil	− 5
			100	− 5	− 6	− 15	− 28
			200	−15	− 6	− 15	− 37
			400	−20	−15	− 15	− 52

Table 14.—Changes in Weight and Dimensions of Cellulose Acetate and Acetate Butyrate Film under Conditions of Mild Humidity.

Sample No.	Material	Thickness in mils.	Period of Test in days	Parts per Thousand Change in :—			
				Length	Width	Thickness	Weight
1	Cellulose Acetate Butyrate	2.5	7	−27	−10	+ 80	+ 12
			100	−33	−27	+ 40	− 34
			200	−33	−30	+ 40	− 36
			400	−33	−33	+160	− 39
2	Cellulose Acetate Butyrate	4.0	7	− 5	−3.5	− 25	+ 26
			100	−10	− 6	− 25	+ 30
			200	−10	−12	− 25	+ 32
			400	−10	−12	+ 25	+ 46
3	Cellulose Acetate Butyrate	2.0	7	Nil	Nil	−120	+ 10
			100	−22	−23	− 80	− 75
			200	−28	−23	− 80	− 90
			400	−30	−25	−100	−100
4	Cellulose Acetate Butyrate	8.0	7	Nil	Nil	Nil	+ 20
			100	Nil	Nil	+ 12	+ 13
			200	Nil	Nil	− 12	+ 4
			400	−10	− 5	− 75	− 5
5	Cellulose Acetate Butyrate	9.0	7	Nil	Nil	+ 11	− 2
			100	Nil	Nil	+ 11	+ 24
			200	Nil	Nil	+ 11	+ 24
			400	− 5	− 8	− 11	+ 22
6	Cellulose Acetate ..	3.5	7	− 5	Nil	Nil	− 52
			100	−30	−27	Nil	− 75
			200	−40	−47	Nil	− 78
			400	−90	−84	Nil	− 67
7	Cellulose Acetate ..	2.2	7	−12	−12	−140	− 35
			100	−15	−20	−140	− 50
			200	−20	−22	−140	− 50
			400	−28	−28	−240	− 45
8	Cellulose Acetate ..	1.6	7	−10	−10	− 60	− 32
			100	−10	−20	Nil	− 40
			200	−10	−20	Nil	− 25
			400	−15	−25	− 60	− 32
9	Cellulose Acetate ..	2.5	7	−15	−15	− 80	− 52
			100	−25	−25	− 80	−124
			200	−25	−25	− 80	−128
			400	−30	−30	−120	−140
10	Cellulose Acetate ..	2.0	7	Nil	− 5	Nil	− 24
			100	−20	−25	+ 40	− 72
			200	−40	−50	+ 80	− 68
			400	−70	−75	+ 40	− 75
11	Cellulose Acetate ..	7.0	7	− 8	Nil	Nil	− 28
			100	−20	Nil	+ 15	− 62
			200	−30	Nil	+ 30	− 70
			400	−40	−35	+ 30	− 74

acetate films, Nos. 6 and 9, move appreciably, No. 6 superficially, and No. 9 in all three directions; both lose appreciable weight. Nos. 7, 9 and 10 are also poor, but No. 8 gives fair performance.

Viewing the tests on films as a whole, the acetate butyrates give better performance on the stability tests than do the acetates, without sacrificing strength or ductility.

Considering the complete range of acetate butyrate products all forms would be welcomed by industry, but the moulding powders are particularly sought. Ease of moulding by the injection method to give relatively stable mouldings is very attractive. The "odour" feature is a characteristic that can only be commented upon after extended practical experience with these materials.

High Acetyl Cellulose Acetate

Subsequent to the publication of the first section of Mr. E. E. Halls's article, "Cellulose Acetate Butyrate" in the December issue, we approached the Plastics Division of Courtaulds, Ltd., for additional notes and data regarding the performance of high acetyl cellulose acetate which so far as this country is concerned may be regarded as satisfying stringent demands where normal cellulose acetate fails. We have now received the following data which we have much pleasure in publishing.

The lower percentage of available hydroxyl groups in high acetyl (56-58.5 per cent. acetic acid) cellulose acetate confers a greater water resistance than exists in the normal plastics grade (52-54 per cent. acetic acid). The dimensional stability of the high acetyl material, particularly in humid conditions, is consequently superior to the normal acetyl material.

The following tests have been made on moulding powders prepared from cellulose acetates of 54, 56 and 58 per cent. acetyl (expressed as acetic acid) known as normal, HA (high acetyl) and WR (water resistant) types respectively:—

1. Injection moulded discs 2 ins. diameter and $\frac{1}{8}$ in. thick were kept at 25 degrees C. and 75 per cent. RH for 48 hours, followed by treatment at 50 degrees C. and 100 per cent. RH for a further 48 hours, after which time changes of weight and dimensions were recorded as shown below.

Type	Normal		HA		WR	
Flow grade	M	H	H	H2	H3	H4
% change						
in weight	+2.7	+2.6	+2.3	+2.2	+1.2	+1.0
in diameter	−7.0	−6.0	−4.0	−4.0	−0.2	−0.1
in thickness	+12.0	+10.0	+6.0	+5.0	+1.0	+1.0

2. Moisture absorption tests were carried out on specimens prepared from 0.06-in. sheet. The test method used is that described in B.S. 1524, Cellulose Acetate Moulding Materials, in Appendix E.

	Normal	HA	WR
Moisture Absorption	+2.2%	+1.7%	+1.2%

3. Some tests were carried out on the three materials according to ASTM D.56-46T resistance of plastics to accelerated service conditions. The tests were done on injection moulded discs 2 ins.

(Continued on page 41)

Polystyrene Emulsion Paints

The high chemical and water resistant properties of polystyrene have aroused much interest in paint manufacturing circles during the last few years as a main ingredient in the so-called "distempers" or "water paints." So far few details as to the actual formulation and production of such paints have appeared in the press, so that the following notes which form part of a laboratory report of the work on the subject carried out by the Development Division of Monsanto Chemicals Ltd. will be of interest.

POLYSTYRENE latices (aqueous dispersions of polystyrene) are being used in increasing quantities for the preparation of emulsion paints for both interior and exterior applications.

These materials are preferred to the traditional distemper and oil-bound water paints, because of their superior qualities with respect to the following properties:—

(1) Washability.
(2) Film appearance.
(3) Sealing over "new plaster."
(4) Brushability.
(5) Flexibility and adhesion.
(6) Chemical and stain resistance.
(7) Colour retention.
(8) Freedom from odour.
(9) Resistance to oxidation.

Experimental Polystyrene Latex RD3925 has been developed for preparing emulsion paints and is at present being produced in pilot-plant quantities.

The purpose of the report is to describe this material, the methods of preparing emulsion paints and to suggest a number of simple formulations which can be used as a basis for development work by the paint manufacturer.

Summary

The properties of Polystyrene Latex RD3925 are discussed together with the basic principles of using this material for the production of emulsion paints.

A basic formulation is given with details of the materials and methods used for preparing products of this type.

The importance of using a suitable protective colloid during compounding is stressed and the relative merits of casein and Lustrex X820 are discussed.

The essential role of plasticizers in producing continuous paint films from the latex is mentioned and the effect of variation in the plasticizer content of the paints is discussed and illustrated by means of formulations developed in the laboratory using Aroclors (chlorinated diphenyls) and ester-type materials.

Variations in filler content are also mentioned in the bulletin and similarly illustrated by formulations with resin/pigment ratios varying between 1 to 4 and 1 to 6 and suggestions are made for the production of coloured paints, primers, and clear finishes.

Properties of the Latex

Polystyrene Latex RD3925 is an alkaline aqueous dispersion of polystyrene containing approximately 45 per cent. solids dispersed with the aid of an anionic emulsifying agent. The physical properties are as follow:—

Total solid content	45 per cent. approx.
Specific gravity at 25 degrees C.	1.015-1.020
Viscosity cps. at 25 degrees C. (Ferranti)	50-60 cps.
Particle charge	negative
pH of emulsion	8.5
Miscibility with water	infinite
Plasticizer	none
Effect of freezing	stable to —5 degrees C.

Since the latex is dispersed in an alkaline medium with the aid of an anionic emulsifying agent it follows that only anionic or non-ionic protective colloids, dispersing agents, etc., should be used during the addition of fillers and pigments, and that the latter materials should be free from acidity and contain no appreciable quantities of water-soluble compounds likely to coagulate the latex (polyavalent metal salts, etc.).

Plasticization of the Latex

Polystyrene Latex RD3925 requires the addition of a plasticizer during compounding to ensure the production of a continuous film on drying. The ratio of solids to plasticizer will vary according to the plasticizer used, but in general will lie between 1 to 0.5 and 1 to 1.2. The post plasticization process (addition of a plasticizer during compounding) offers the advantage that it leaves the manufacturer of polystyrene emulsion paints free to choose the quantity and type of plasticizer best suited to his particular requirements.

Post plasticization can be carried out without difficulty in the factory since the latex takes up plasticizer very readily and plasticization and compounding can usually be carried out in a single continuous operation. Satisfactory paint films can be produced immediately after plasticization and compounding of the latex, although it is usually found that their properties are improved by storing the finished paints for one or two days before brushing out.

The quantity of plasticizer to be added will depend upon both the nature of the plasticizer and the film hardness required. Ester-type plasticizers, e.g., dibutyl phthalate, dioctyl phthalate, tricresyl phosphate and certain chlorinated diphenyls, e.g. Aroclors 1248 and 1254, are suitable for this purpose.

Method of Compounding

In general, emulsion paints are produced from the latex by means of a simple two-stage process which consists of (a) preparing an aqueous dispersion of pigments, plasticizer, etc., with the aid of suitable anionic or non-ionic protective colloids and dispersing agents and (b) mixing the dispersion thus obtained with the latex in some convenient manner.

The method of preparing the aqueous dispersion of pigments, plasticizer, etc., may be varied from a simple stirring technique, to techniques involving the use of grinding equipment such as edge runners, colloid mills, etc., according to the machinery available in a particular factory.

For the purposes of this bulletin details of four processes based on the use of (a) a stirrer (b) an edge runner (c) a colloid mill and (d) a ball mill, have been given, but it will be appreciated that if necessary, these may be modified or combined together to suit the plant available.

The "grinding efficiency" of the equipment used for preparing the pigment/plasticizer paste will, to a large extent, determine the quality of the dispersion obtained from a given formulation. In this connection, it may be mentioned that paints produced using the edge runner, colloid mill, and ball mill are superior to those prepared by stirring.

The quantity and type of protective colloid, dispersing agent etc., used will also have an important bearing on the quality of the dispersion obtained and in maintaining the stability of the finished product.

Two protective colloids are recommended in this connection, viz., casein and Lustrex X820, the latter being a water-soluble polymeric protective colloid which has the dual advantage of producing water-resistant films on drying at room temperature and resisting attack by fungi, bacteria, and peptising enzymes.

The following table gives the data for the production of a basic formulation (white satin finish). Coloured products may be obtained by replacing some or all of the white pigments with coloured materials.

Basic formulation (White Satin Finish)

	Ingredients	pts. wt.	Stirring	Edge Runner	Colloid Mill
Pigment-Plasticiser Paste	Titanium Dioxide ..	250	—	—	Mix
	China Clay	60	30 mins.	10 mins.	5 mins.
	Lactic Casein ..	20	—	—	—
	Santobrite (Preservative)	2	—	—	—
	Water	200	—	—	—
	Dispersing agent (a)	10	—	—	Mix
	.880 Ammonia Solution..	4	15 mins.	5 mins.	5 mins.
	Defoaming agent (Pine Oil)	2.5	—	—	—
	Aroclor 1254 (Plasticiser)	88	40 mins.	15 mins.	Mix 5 mins. and then mill
Latex Component	Water	85	—	Stir	Stir
	Polystyrene Latex RD 3925	220	30 mins.	20 mins.	20 mins.
	Thickening agent (b)	6.5	—	—	—

(a) Polyethylene glycol mono laurate. (b) 12 per cent. ammonium polymethacrylate solution.

As an example, the following give details of production on an edge runner.

The titanium dioxide (250), clay (60), casein (20), Santobrite (2) and water (200) are pasted together in an edge runner mill and worked for 15 mins. The dispersing agent (10), .880 ammonia solution (4) and defoaming agent (2.5) are then added and, after working for 5 mins. the plasticizer—Aroclor 1254 (88)—is added and working continued for a further 15 mins. Finally the residual water (85) is added, working on the edge runner discontinued and the paste mixed with the latex either by stirring the Polystyrene Latex RD3925 (220) slowly into the paste or vice versa whichever is the most convenient.

After mixing the paste and latex, stirring is continued for 30 mins. to obtain the finished product.

Protective Colloids

Casein has been used as a protective colloid in most cases throughout the bulletin since most paint manufacturers are familiar with its use. Disadvantages associated with the use of casein are, however, that its solutions (unless suitably preserved) tend to lose body rapidly during storage and are readily attacked by fungi and bacteria, giving rise to unpleasant odours in the can and stains in the dried films. It is suggested that the use of Lustrex X820 may replace casein to advantage in the basic formulation. Lustrex X820 is a synthetic protective colloid of the same order of efficiency as casein, but resistant to attack by fungi and bacteria and more stable to storage in solution. In addition, films obtained from aqueous solutions of Lustrex X820, by drying at room temperature, are not readily redissolved and thus enhance the water resistance of the emulsion paint films in which it is used.

Other protective colloids may be used to replace casein, e.g., ammonium and sodium alginate, carboxy methyl cellulose, ammonium and sodium polyacrylates, etc., but laboratory experiments to date have suggested that these materials are less efficient than casein or Lustrex X820, and require the addition of larger quantities of dispersing agent to obtain adequate stability.

Preservatives, Dispersing Agents and Defoaming Agents

If casein or similar materials are to be used as protective colloids it is important that a preservative should be added to prevent the occurrence of fungal and bacterial attack. Santobrite (sodium penta-chlorphenate) is recommended for the purpose. (0.25 per cent. dry weight preservative calculated on the total weight of paint was found to be sufficient to protect material inoculated with a variety of organisms after incubation for a prolonged period at 25 degrees C.).

Dispersing agents are used to assist in preparing the pigment/plasticizer paste and for this purpose polyethylene glycol mono laurate was used throughout the work. Glyceryl mono ricinoleate, however, may also be used.

The use of defoaming agents is recommended to prevent the occlusion of air in the paint during preparation.

This is important since foaming increases the viscosity of the paint and results in the production of pin holes in the paint films. Pine oil and the silicone oils are suitable for this purpose.

Plasticizer

As has already been stated, the inclusion of a suitable plasticizer is essential to the production of continuous films from Polystyrene Latex RD3925. Both ester type plasticizers and Aroclors 1248 and 1254 (chlorinated diphenyls) gave satisfactory films in the laboratory, the latter (particularly Aroclor 1254) giving somewhat harder films.

Decreasing the quantity of plasticizer, in general, results in the production of a harder paint film provided that the plasticizer content is not reduced below the minimum required for the production of a continuous film.

Thickening Agents

Additional thickening agents may be added to the emulsion paints produced from Polystyrene Latex RD3925 to adjust the final consistency to any required value.

Aqueous solutions of polymeric materials such as ammonium and sodium polyacrylates and methacrylates, carboxy methyl cellulose, sodium alginate, etc., have been used successfully for this purpose.

HIGH ACETYL CELLULOSE ACETATE

(*Continued from page 39.*)

diameter and $\frac{1}{8}$ in. thick which were conditioned for 24 hours at 25 degrees C. and 75 per cent. RH. The following test procedures were used:—

Procedure I

(a) 24 hours at 60 degrees C. and 88 per cent. RH.
(b) then 24 hours at 60 degrees C. in an oven.

Procedure VI

(a) 24 hours at 40 degrees C. and 100 per cent. RH.
(b) then 24 hours at 60 degrees C. in an oven.

Procedure VII

(a) 24 hours at 50 degrees C. and 100 per cent. RH.
(b) then 24 hours at 50 degrees C. in an oven.

After conditioning, the discs were measured in diameter and were weighed and these measurements were then repeated after the first part (a) and then the second part (b) of the test. The results, which are on average of two determinations, are expressed as a percentage change on the original.

	Procedure I			Procedure VI			Procedure VII		
	W	D	T	W	D	T	W	D	T
Normal ..	+2.7	−10.1	+12.0	+2.5	+0.4	+0.8	+1.4	−1.5	+5.6
High Acetyl..	+2.3	−6.1	+4.0	+2.1	+0.5	+0.8	+1.4	+0.3	+1.6
WR.	+1.9	−1.6	−1.1	+1.9	+0.4	+0.8	+1.2	+0.6	+1.6

W = Weight. D = Diameter. T = Thickness.

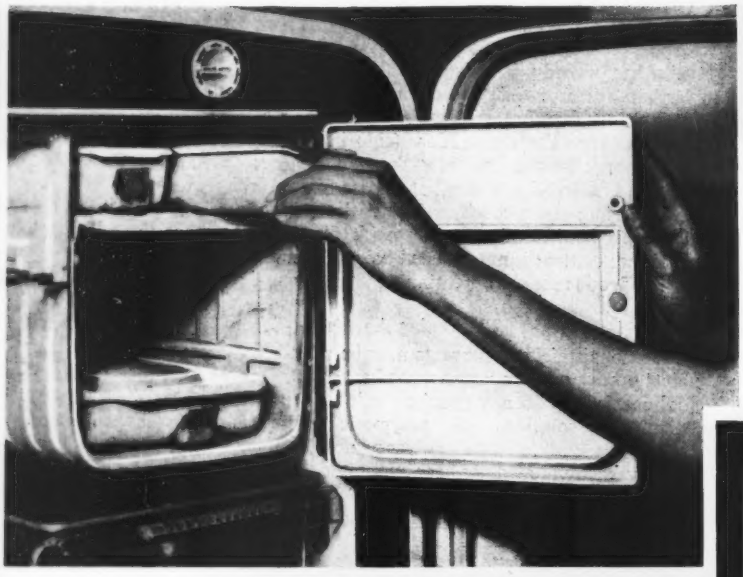
4. HA and WR type moulding powders have a greater resistance to surface marking and warping than the 54 per cent. acetyl material when immersed in hot or boiling water. Tests carried out on 2-in. discs and injection moulded beakers (1½ hrs. in boiling water) showed that normal acetyl materials shrink, the surface crazes and transparent mouldings become milky and opaque. High acetyl shrinks to a lesser degree but becomes somewhat crazed. WR type is hardly affected.

PLASTICS
IN THE SERVICE OF MAN

A pictorial review of high-quality units moulded or otherwise fabricated in Great Britain . . .

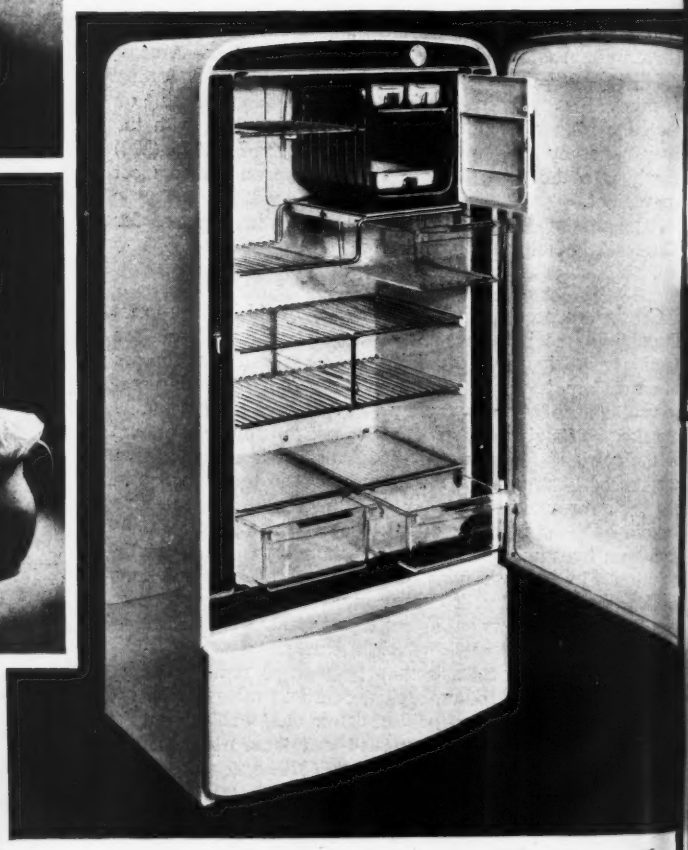
36. Refrigeration—I

(Above) Fitting breaker strips to Frigidaire refrigerators. The co
ponents are manufactured by E. K. Cole Ltd., of styrene co-polyr
of very high flexural strength.

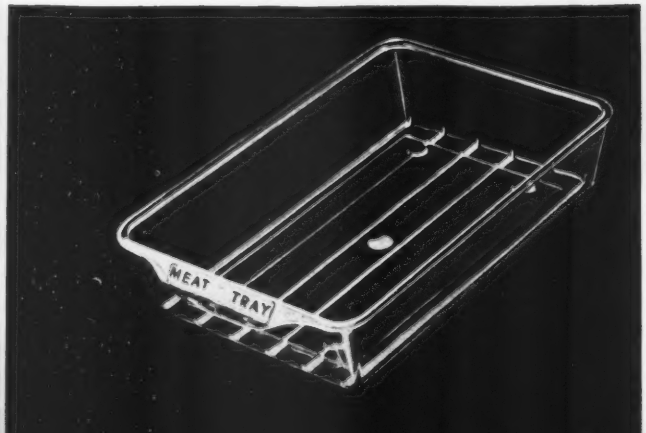


(Left) Self-closing door of the freezer unit in the English Electric 76A refrigerator is white polystyrene moulded by British Moulded Plastics Ltd., with a Perspex name-plate by Wilmot-Breeden Ltd.

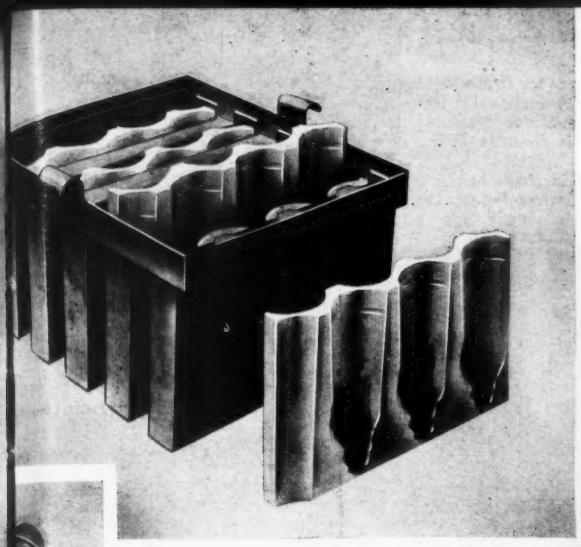
(Right) Food covers of polythene film manufactured by Cascelloid Ltd., especially useful for refrigeration purposes.



(Above) English Electric Co. Ltd.: 76A refrigerator which contains several pl
components. The inner panel of the refrigerator door is a paper base laminate mo
by Micanite and Insu'ators Co. Ltd., as is also the breaker strip surrounding
inside of the cabinet. The two Humi-drawers and the meat keeper are of polyst
moulded by British Moulded Plastics Ltd.

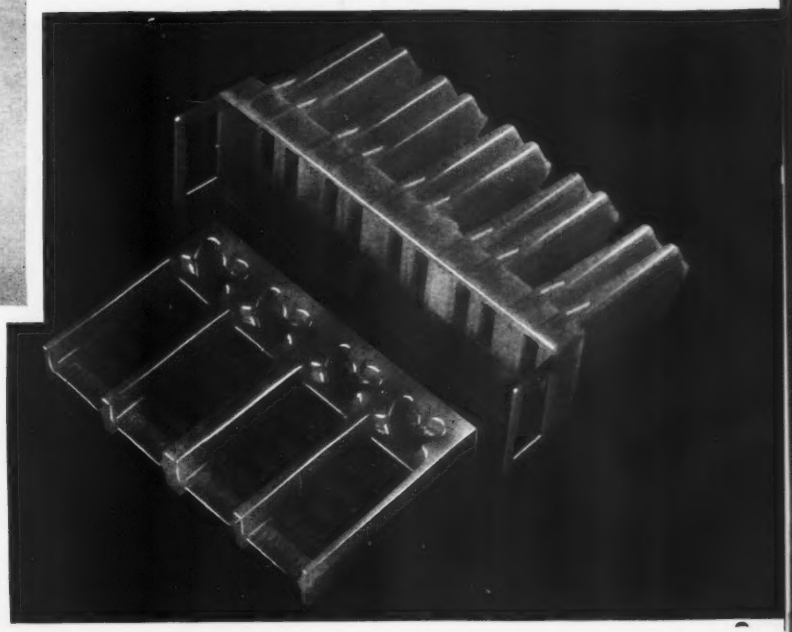


(Left) Chill tray (15 ins. by 10 ins.) moulded in clear polystyrene by British Moulded Plastics Ltd.



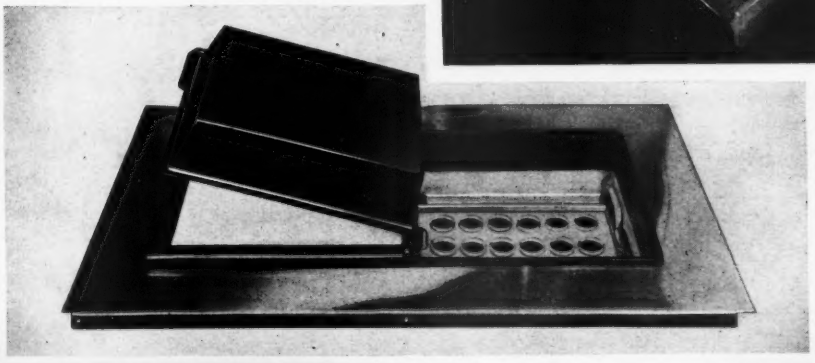
(Left) Polythene moulds for ice lollies, manufactured by J. F. Kenure, Ltd., for Aero Pipe and and Glass Co., Ltd.

(Below) To the right is shown a one-piece injection moulding by J. F. Kenure, Ltd., in polythene, for use in freezers manufactured by the Aero Pipe and Glass Co., Ltd. To the left is a polythene mould for use in the same freezer, designed for Coronation Year.

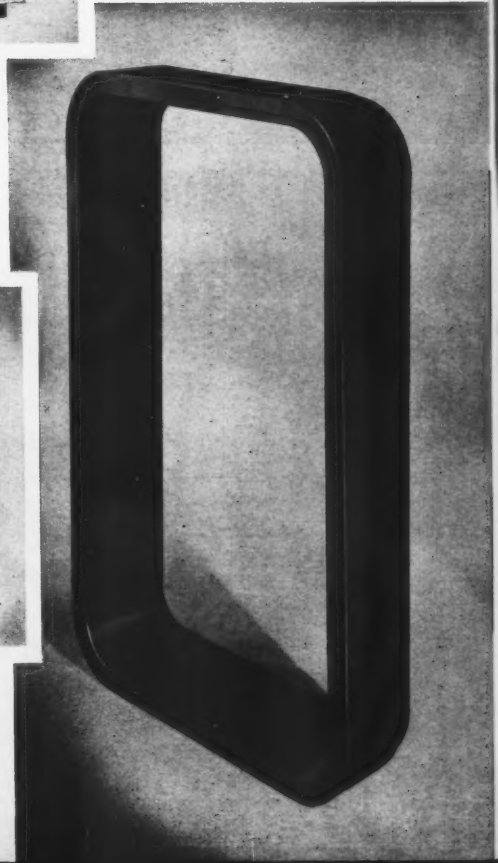


(Left) An ice lolly from the moulds shown above.

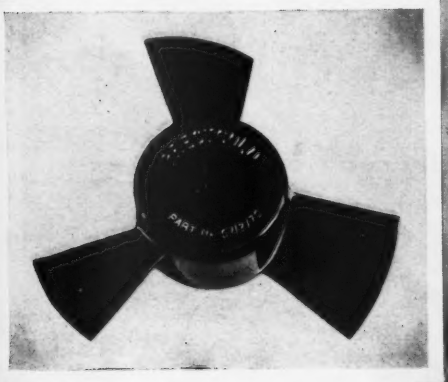
(Below) Top of Aero Pipe and Glass Co., Ltd.'s freezer which includes a moulded cover to the base of the hinged lid, made by J. F. Kenure, Ltd., of cellulose acetate, and also an insulating strip of extruded p.v.c.



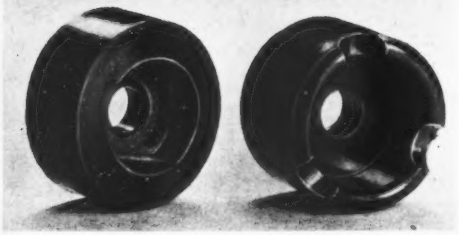
(Below) A refrigerator door trim moulded from phenolic powder manufactured by Bakelite, Ltd.



(Below) A fan produced from Bakelite phenolic moulding powder by the Streetly Manufacturing Co., Ltd., for Prestcold Refrigerators made by the Pressed Steel Co., Ltd.

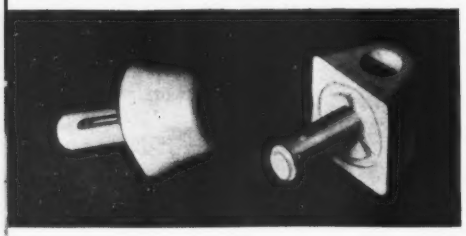


(Left) Breaker strips of polystyrene for the Frigidaire refrigerator, moulded by E. K. Cole, Ltd.



(Above) Terminal bushes for the motor assembly of Frigidaire refrigerators, moulded by Lacrinoid Products Ltd., in medium shock phenolic materials.

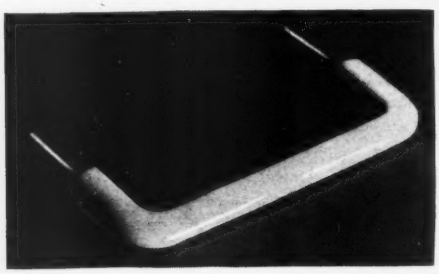
(Below) Shelf supports for the Frigidaire refrigerators are moulded from polythene (left) and styrene co-polymer (right) by E. K. Cole, Ltd.



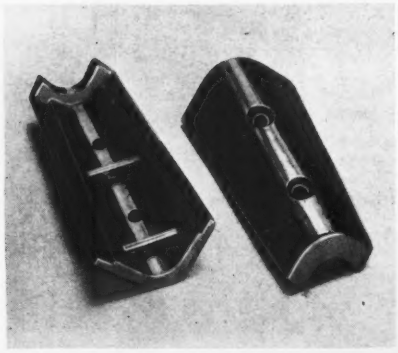
(Right) Corner pieces used on the doors of Electrolux refrigerators, moulded in medium shock phenolic powder by Lacrinoid Products, Ltd.

(Below) Rotary seal made for Crane Packing Ltd., of Slough, Bucks., to seal Freon liquid is manufactured from Lacrinite graphite-loaded moulding material by Lacrinoid Products, Ltd.

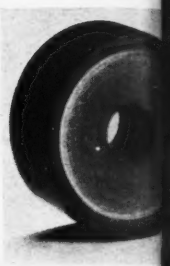
(Below) Standard 2546 Lacrinoid handle supplied to the Longford Engineering Co. Ltd.

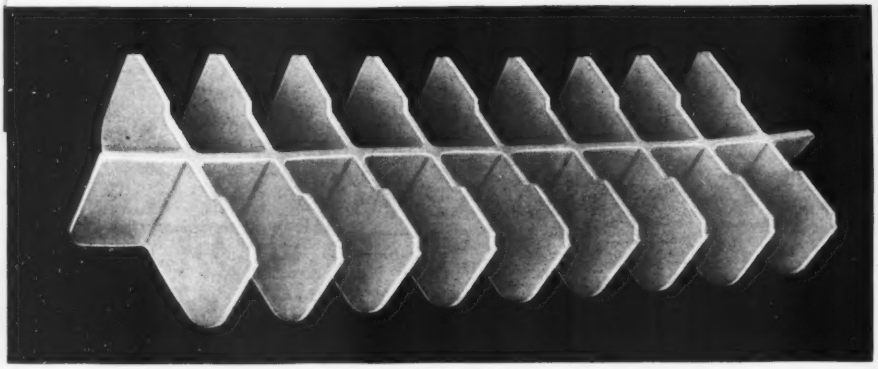


(Above) Handle of evaporator door of the English Electric refrigerator made of Diakon by Lacrinoid Products Ltd.

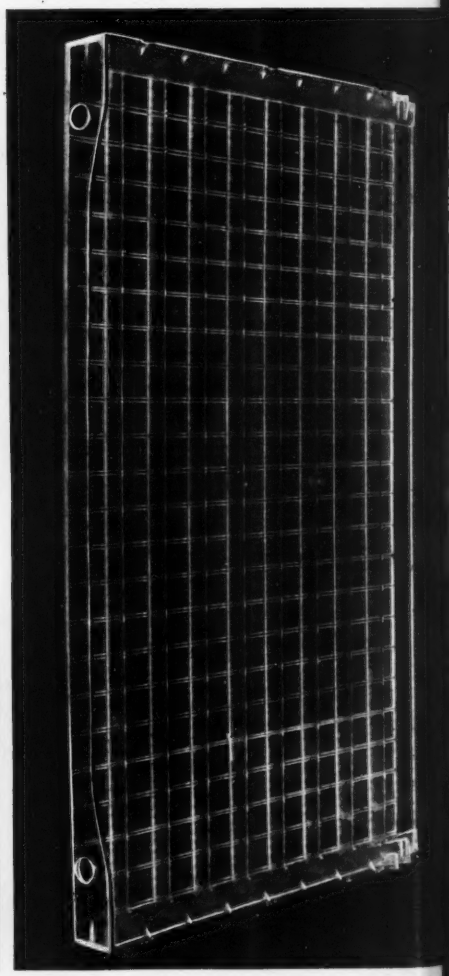


(Right) Spacer used by Kelvinator Ltd., machined by Lacrinoid Products Ltd. from cast phenolic manufactured by Catalin, Ltd.

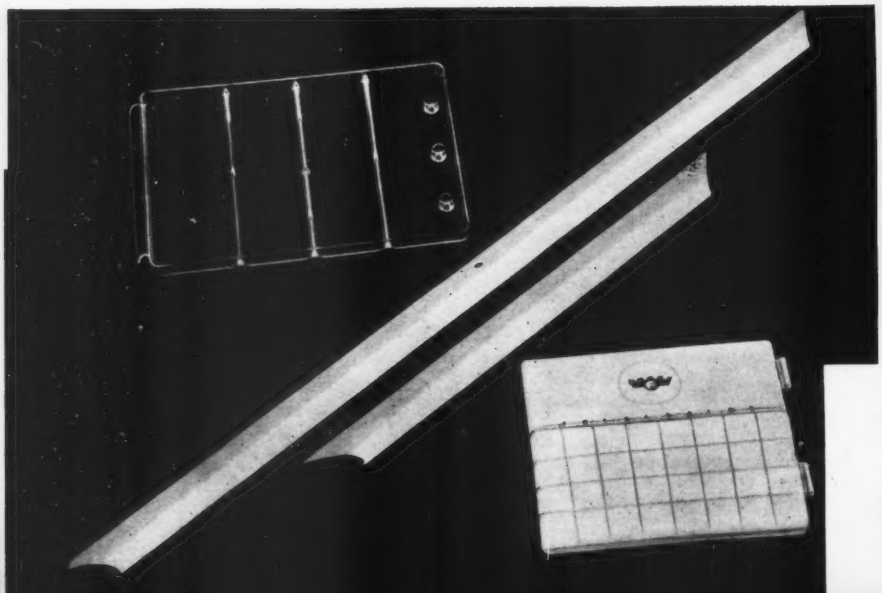




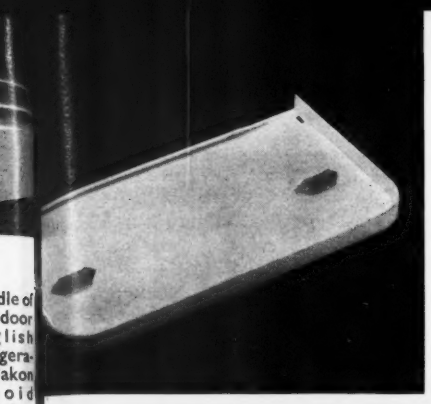
(Above) An ice-cube separator, moulded in polythene by E. K. Cole, Ltd.



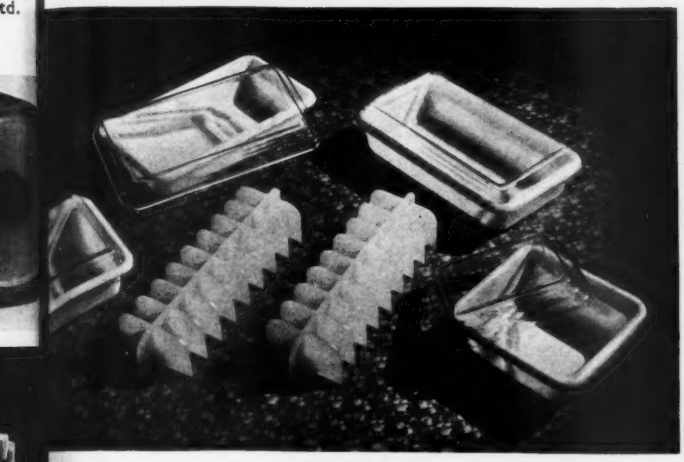
(Above) Crisper cover moulded in clear polystyrene by E. K. Cole, Ltd., for Nash-Kelvinator, Ltd.



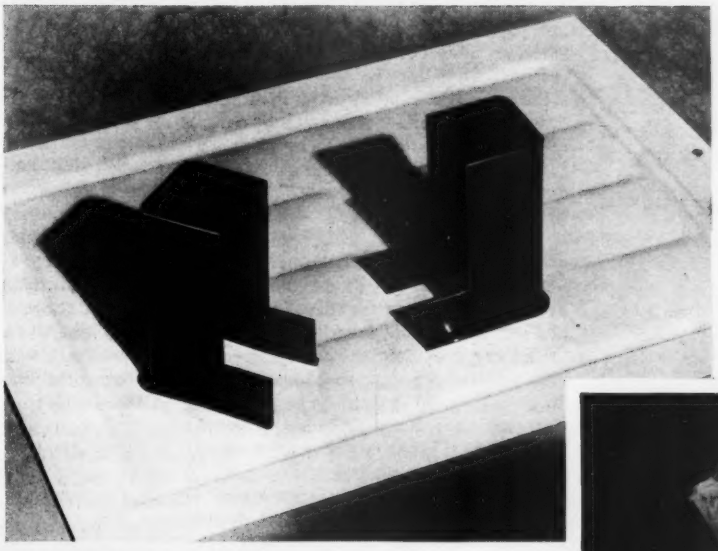
(Left) A clear drip tray and door trim strips moulded in polystyrene and evaporator door moulded in co-polymer of styrene by E. K. Cole, Ltd., for Frigidaire.



(Left and right) Two refrigerator back plates moulded by British Moulded Plastics, Ltd., in white polystyrene, for the International Refrigerator Co. Ltd.



Above) A group of re-rigerator dishes pressed rom "Perspex" and ice ontainers moulded in lkathene, manufactured y Thermo-Plastics, Ltd.

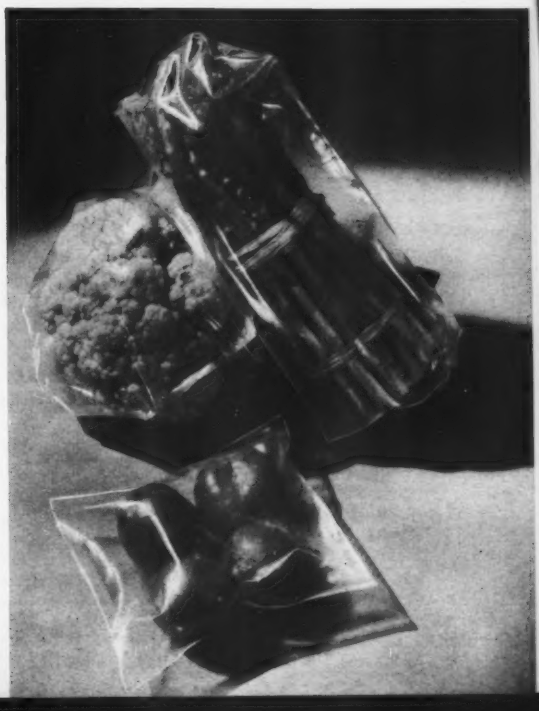


(Above) Refrigerator evaporator door for International Refrigerator Co., Ltd., in white polystyrene, manufactured by British Moulded Plastics, Ltd.

Right) Refrigerator door ner and cold radiator overs made from rigid .v.c. sheet manufac-ured by I.C.I., Ltd., Plastics Division.

(Below) Alkathene tubular film, made from I.C.I., Plastics Division, material, has proved particularly suitable for packaging foodstuffs in cold storage.

(Left) Crispator for Prestcold domestic refrigerator, moulded by British Moulded Plastics, Ltd., in clear polystyrene.



National Packaging Exhibition

THE visitor to last month's National Packaging Exhibition at Olympia will have brought away with him a strong impression that the role of plastics in packaging is of the greatest importance. Two years ago at the same exhibition we were able to see a number of new developments. This year these developments have gone from the stage of curiosities to become the everyday materials of packaging experts in every field. Where plastics were a novelty, they are to-day not only accepted but actually sought by the packer. He is prepared to discuss in detail with knowledge and experience the technical advantages and the economic gains of using these materials.

There is no doubt that particularly in the field of protective packaging—as distinct from packaging for sales appeal—the Ministry of Supply has done a great deal to spread knowledge of these technical advances. As part of the convention, held on the occasion of the exhibition, Mr. D. J. Evans of the Materials and Explosives Research Development Department of this Ministry, talked about problems in Service packaging materials. Some of the points which he made may be of interest to the plastics industry:

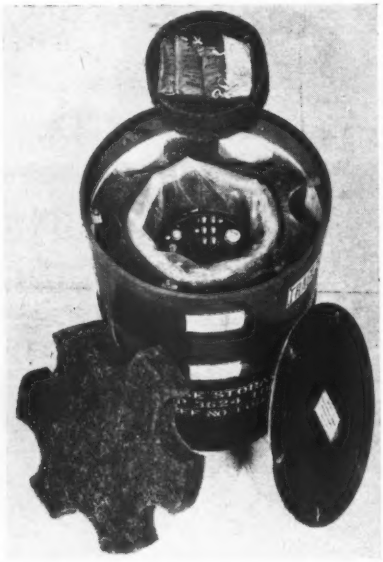
"In talking to those who are concerned with the commercial side of packaging there are two concepts of Service packaging which are commonly but erroneously held. One is that expense is no object, and hence, we are extravagant; and the other is that the detailed system of specifications* for materials and methods results in our being very resistant to change in the adoption of new ways. Both these ideas probably arise from the fundamentally different requirements which exist between Service and commercial packaging. The commercial packer has always to deliver his goods in perfect condition to his customers, whose distance from him in time and place can be fairly easily gauged. The Service packer, however, has to deliver his goods to the user whose distance from him in time and place may vary from next week and next door, to many years hence in any part of the world. For this reason we cannot calculate what should be spent on a package by taking a percentage of the cash value of the item packed. Nor can we consider 'insurance economies.'

"By which I mean that we cannot balance the cost of replacing damaged goods against the cost of a more efficient pack. We have to aim at supplying the Services with equipment, all of which is in perfect condition whenever and wherever it is needed. There are many reasons why this is so but two will suffice: 1, If damaged in transit many Service stores may constitute a danger to life or installation; 2, In an emergency, every piece of equipment and every cubic foot of storage space may be vital to the campaign.

"The Ministry is active not only in examining the possible uses of new materials which become commercially available, but also in developing new methods of adapting available materials to the needs of Service packaging. It is hoped that some aspects of our work may prove of value to commercial interests, since many problems of supply and cost are eased where a commercial demand exists as well as a Service one. Any approach to us by commerce is always welcome and I am sure that close contact between industry and the Ministry of Supply on problems of packaging must be to their mutual advantage."

Some of the individual problems which Mr. Evans considered, will be dealt with later when we come to consider aspects of protective packaging, which include film wrapping, dip and spray coating, preformed cushioning materials and the use of plastics-based adhesive tapes for sealing and for label protection.

Both film material and mouldings were to be seen in use as packs combining good functional wrapping with display value. More products are now sold in polythene bottles and liquids packed in sachets of p.v.c. and polythene film are also on the increase. Fabricated acetate boxes were seen on several stands, showing the sales value of transparent packs.



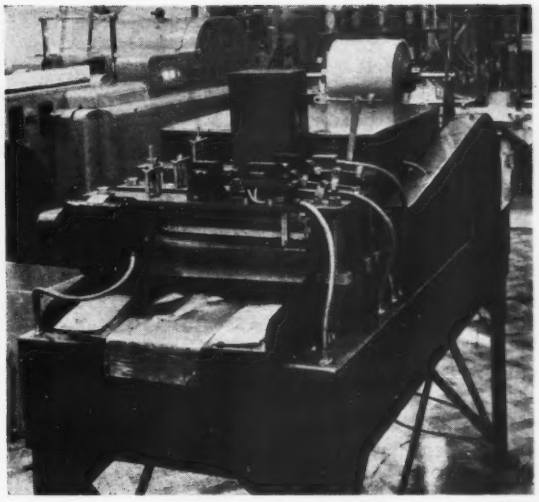
Packaging of airborne electronic equipment—S. C. Schuler of Telecommunications Research Establishment showed this example of packing a transmitter/receiver—using plywood outer case, moulded cushioning of rubberized hair, and polythene moisture barrier.

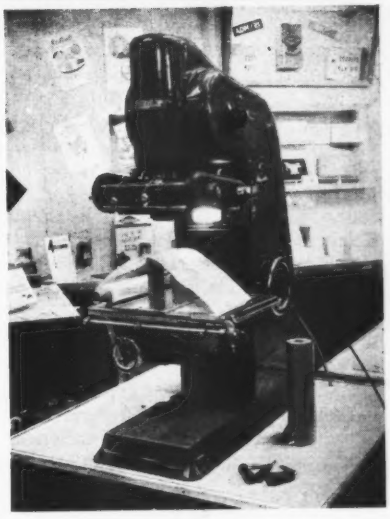
* The "Services Packaging Manual" is issued by M.o.S. as a guide to these specifications and the materials suitable for meeting their requirements.

Polythene

The most remarkable material in the extensive range of its application to packaging is polythene. Imperial Chemical Industries, Ltd. (Plastics Division), manufacture the raw material for all forms, and also produce extruded lay-flat tubing and flat film. There are now a number of other manufacturers producing film and tube, these include: British Cellophane, Ltd.; B.X. Plastics, Ltd.; Chiltern Paper Products, Ltd.; and Transparent Paper, Ltd. These films are converted by heat-sealing methods into bags, or are joined together to make sheets sufficiently large to provide a complete wrap for items such as cars or large pieces of machinery. The use of a completely sealed polythene film wrapping for assembled machinery avoids the intricate process of dismantling and individually protecting each component from corrosion; in consequence, machines may be unpacked at their destination and put into immediate service. Since a certain amount of moisture must be present in the air when the wrap is sealed, desiccants such as silica gel are usually incorporated in the pack. Once encased in this moistureproof envelope, equipment to be packed only requires grading to provide mechanical protection. I.C.I. showed several photographs of such wrapped equipment, and W. J. Reynolds (Motors), Ltd., export packers, showed a Grand Prix car and a bottle-filling machine completely sealed in 0.005-in. film.

Charles E. Douglas and Co., Ltd., have produced two machines specifically designed to handle polythene film. The Strand fully-automatic carton-wrapping machine is for the full overwrapping of cartons and other rectangular articles. The standard model is not adjustable for variation in carton sizes, each machine being built to meet the user's specific requirements. A full hermetic seal of both the longitudinal overlap and end-folds of the film is obtained. Output is 35 cartons/minute. Provision is made for electric-eye registration if printed film is used. Open-topped cartons can be wrapped with no displacement or damage to the contents. Cartons are fed to the machine by a belt conveyor, sleeve-wrapped with film and the longitudinal joint sealed by a novel patented method. Further progress through the machine adds full overlapping endfolds of the





Three new machines for handling polythene film: (Above) carton overwrapping machine and (above, right) bag-making machine, both by Charles E. Douglas and Co. Ltd.; (right) hot foil transfer machine for embossing/printing polythene (Masson Seeley and Co. Ltd.)

film at both ends of the cartons, and these endfolds are also heat sealed with a full fusion to all film joints. Cartons are discharged by a conveyor ready for final packing. One operator can easily attend to two of these machines, more if full conveyor feed and removal is provided.

The Strand fully-automatic bag-making machine is for the continuous manufacture of polythene bags from flat, tubular or gusseted film. Bags of maximum width of 15 ins. are produced at 60 bags per minute up to a length of 12 ins. and 30 per minute with a length between 12 ins. and 24 ins. For narrow bags, a number of film reels may be mounted in parallel and the output multiplied. Distance of seal from end of bag is infinitely adjustable. Film is fed from the reel in a straight line through the machine, which overcomes the difficulty of film sticking to rollers by static or other causes. Continuous variation of bag length with accurate control is ensured by a patented method without the use of change parts or mechanical linkage alteration. Full control of the pressure, time cycle, and temperature of the transverse weld is provided, thus giving optimum conditions for all film thicknesses. During the welding and guillotining cycle the film is securely locked, so that no tension or strain is placed upon the weld.

Printing on Polythene

The high chemical resistance which characterizes polythene has created problems in printing the material in film as well as in moulded form. Several techniques have, however, been developed, among them being a pre-treatment according to the American Shellmar Process which renders the film printable by conventional methods such as photogravure and aniline (Transparent Papers, Ltd.), and a hot foil transfer method (Masson Seeley and Co., Ltd.). This machine can be hand-operated or run automatically—wide ranges of pressure and heat being possible. Printing on polythene bottles presents more difficulties but Cascelloid, Ltd., appear to have produced a durable print.

Polythene film has also been laminated to paper (Chiltern Paper Products, Ltd., Telegraph Construction and Maintenance Co., Ltd.), to provide an extremely strong and moisture-proof packaging material. Mr. Evans (Ministry of Supply) commented on such laminates.

" Polythene has many properties which commend it to the Service pack designer but its usefulness could be extended if it were available as a laminate with, say, metal foil or a fabric. Its combination with paper gives a sheet which does not drape well and an examination of the characteristics of the new types of bonded fibre fabrics has led us to believe that a laminate of polythene and one of these fabrics would give an interesting new wrapping material."

Polythene/paper laminates are also used as non-toxic moisture-proof liners for bottle caps (Metal Closures, Ltd.), and as carton liners (Paper Goods Manufacturing Co., Ltd.).

In moulded form several companies make use of polythene. Cascelloid, Ltd., and Telegraph Construction and Maintenance Co., Ltd., both produce bottles useful for their almost complete indestructability by chemical or mechanical action. The last-named company use a reinforced design to give even greater toughness.

Other Films

Quantitatively the most important material is no doubt regenerated cellulose film manufactured under the trade names Cellophane (British Cellophane, Ltd.), Diophane (Transparent Papers, Ltd.), Rayophane (British Rayophane, Ltd.), and Sidac (British Sidac, Ltd.). Only the first two of these manufacturers were represented at the Exhibition, but the films were to be seen on the stands of most packaging converters. In addition to the plain film, moisture-proof, heat-sealing and rot-and-fungus-proof grades are produced by coating the film base. Films with high plasticizer content are sufficiently flexible for twist wrapping.

Cellulose acetate film was shown by three manufacturers (British Celanese, Ltd., British Cellophane, Ltd.—as selling agents for Courtaulds, Ltd., and B.X. Plastics, Ltd.). The material is used in its thinnest grades for window cartons—for laminating with metal foil, paper or other films, and in thicker grades for the production of transparent packaging display

British Cellophane, Ltd., are one of the manufacturers now extruding polythene film; they showed a variety of films and made-up packs.

Technopol Laboratories, Ltd., produce a variety of designs of their sachets and tubes for liquid packaging.

boxes. Containers have also been produced by spiral winding and sheet moulding.

Pliofilm, rubber hydrochloride film produced in this country by Goodyear Tyre and Rubber Co., Ltd., is now available for retail sale, in rolls marketed by H. and A. Manufacturing Co., Ltd. A vacuum packaging technique has been developed, called Vacpac, for foodstuffs, such as ground coffee, dried yeast, meat products and cheese. Laminated to Clarifoil cellulose acetate (made by British Celanese, Ltd.), Pliofilm is used for the novel sachet for packaging White Rain Shampoo. Cullen, Carver and Wilshaw, Ltd., one of the converters of Pliofilm, manufacture cask liners from this material.

P.V.C. film has only recently been introduced as a packaging material, but it appears to have a great future for protective wrapping and several manufacturers are producing sheets of a suitable grade, but Velbex calendered sheeting, manufactured by BX Plastics, Ltd., was the only one shown. It is supplied in continuous rolls 48 ins. wide in a range of thicknesses; properties include resistance to water chemicals and oils, and ease of high-frequency sealing. Storage bags of p.v.c. were shown by Porosan, Ltd., and sealed liquid packs made by the continuous Rado process were presented by Technopol Laboratories, Ltd.

Quoting Mr. Evans again, "The use of polyvinyl chloride sheet has so far found little place in Service packaging, but its examination has led to the approval of the thinner grades as a grease-resistance wrap, the alternative to the coated-paper CS2193. Thicker grades are being considered (e.g., 0.010 in.) as an alternative to bitumen-laminated Kraft Union for the fabrication of waterproof case liners. A Service trial has been organized in which packed wooden cases fitted with the two types of liners have been sent to and from destinations in the four quarters of the globe. The trial will not be complete for another three months, but if the outcome is in favour of using p.v.c. sheet in making these liners, two technical problems will have to be tackled: (a) the best design for a sealable p.v.c. case liner, and (b) the most convenient method of sealing the opening (e.g., heat seal, adhesive, etc.). Any ideas on how these should be done will be much appreciated."

Finally, in a review of packaging films the new Terylene polyester film manufactured by I.C.I. must be included, although it was not displayed on the company's stand. This film is extremely strong in very thin gauges and has many other properties looked for in a protective wrapping film.

Self-adhesive Tapes

All the films mentioned above have been used as base materials for self-adhesive or pressure-sensitive adhesive tapes. The most common of these is the cellulose-based tape sold under trade names, such as Sellotape (Gordon and Gotch, Ltd.), Permacel (Johnson and Johnson, Ltd.), Speedfix (Industrial Tapes, Ltd.), etc. It is made transparent or in opaque colours and can be printed in one or two colours. This is done either on the base material before coating with adhesive or, alternatively, by means of special printing machinery on the finished tape. In this form the tape can serve as a label as well as a sealing method. To meet some more stringent demands of export and Service packaging some manufacturers, in particular Arabol Manufacturing Co., Ltd., Gordon and Gotch, Ltd., John Gosheron, Ltd., and Industrial Tapes, Ltd., have produced tapes based on other films. Ethyl cellulose and cellulose acetate tapes are used as waterproof sealing tapes and for label protection to specification CS250. Using such tapes, labels have been identified long after the remainder of the package has deteriorated and disintegrated. Ethyl cellulose is the preferred material, but acetate is accepted because of easier availability. M.O.S. have a complaint about this material: "The trouble with the present tape seems to lie in its springiness, which we think is directly related to thickness of the base. The specification does not limit this thickness, but demands a tensile strength which can be met by a base of a thickness of about .002 in. Tape available on the market is made from base not less than .003 in. thick. This .001 in., we think, makes all the difference between a springy tape and one which lies down nicely. Will someone offer us a tape of .002-in. to .0025-in. cellulose acetate base or must we write this requirement into the specification?"

Polythene tapes have been mentioned earlier; they are used because of their flexibility and "stretch" for sealing irregular-shaped bottle tops and containers. A p.v.c. tape serves the same purpose, but has greater tensile strength.

Adhesives and Coating Materials

Adhesives play a very important part in packaging, and a number of manufacturers represented at the Exhibition demonstrated their synthetic resin adhesives (Arabol Manufacturing Co., Ltd.; BX Plastics, Ltd.; Feculose Co., Ltd.; Gloy and Empire Adhesives, Ltd.; Samuel Jones and Co., Ltd.; and National Adhesives, Ltd.). This last-named company claims to provide a satisfactory adhesive for bonding polythene to other materials, particularly to paper. The large number of different adhesives required makes it impossible to stock "standard lines." Adhesive users must consult with the manufacturer and a special formulation may often be prepared to meet his particular requirements.

Jenson and Nicholson, Ltd., displayed samples of their dip coatings and the liquid envelope spray coating technique. Originally developed in America during the last war, the liquid envelope process provides a tough plastic glove-like film when sprayed on to any surface, including metal, wood, fabric, paper and plastic. The film provides complete protection against deterioration storage and transit, and has wide applications in packaging for many industries.

Dip coating, normally applied to small units, can be incorporated into any normal production line. The coatings can

be contained in baths, and components can be dipped as a routine process to give immediate protection against corrosion. Articles coated in this way are saved from any form of deterioration. Another product of the company is a temporary plastic film coating applied to components during manufacturing processes, e.g., to prevent surface damage to metal parts such as car panels when these are being pressed.

Spray coating for large units is also carried out by several of the trade packaging services such as Export Packing Service, Ltd.

Moulded Plastics

A wide range of moulded containers was shown by Cascelloid, Ltd. This member of the British Xylonite group is probably the most active and versatile plastics company specializing in packaging, for besides moulded containers and polythene bottles they also make film bags and acetate display boxes. New products included a small gum-dispensing bottle, vitamin table containers and a bag for sweets. The two-gallon bottles shown were used by the British North Greenland Expedition for dropping battery acid by parachute.

B.Z. Products, Ltd., use both polystyrene and polythene to produce injection-moulded containers and closures, principally for pharmaceutical products. A new polythene stopper comprises two moulded parts welded together to form a flexible closure giving a particularly good seal.

Screw-thread Moulded Closures

By far the most important outlet of moulded products in packaging is the compression-moulded u.f. and p.f. bottle caps, in fact, a considerable proportion of u.f. moulding powders are consumed in this field and the British Plastics Federation has a separate Moulded Closure Section. On the occasion of the exhibition the Federation made the following statement: "Plastic caps have many advantages. They are robust, light in weight, rustless and available in attractive colours which are not affected by scratching. They are being used satisfactorily with semi-automatic and fully automatic capping machines, but naturally the best results are obtained if certain principles are observed. While a properly designed plastic cap has great strength, it can break or become damaged if it is mishandled either before or in the process of applying it to the container. Treatment received in the hopper of an automatic machine working at unnecessarily high speed will dislodge the liners and break or damage caps. Other causes of cap breakage are inaccuracies in bottle thread, which throw too great a strain on the cap threads, and the use of sealing wads of incorrect thickness.

For all these reasons users are urged to consult the manufacturers of the cap, the container and the capping machine when installation of a machine is contemplated, as well as in the event of subsequent difficulty.

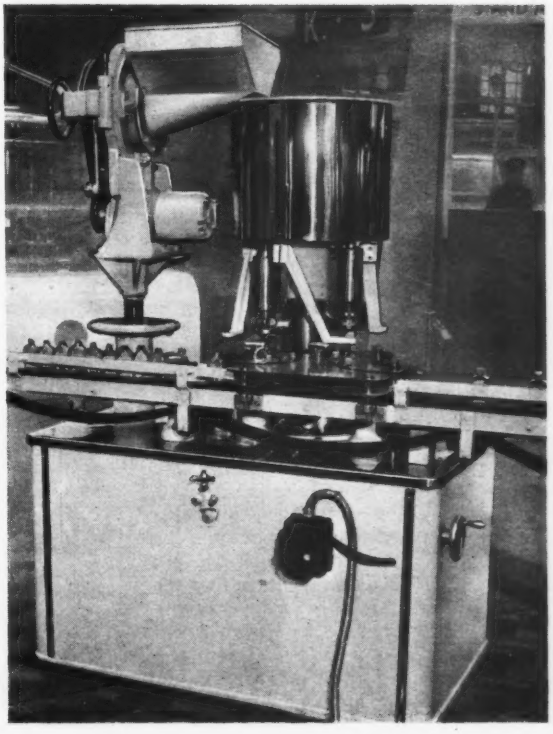
An automatic screw-capping machine of the type mentioned by the Federation was shown by Albro Fillers and Engineering Co., Ltd. This machine is the first of its kind of British manufacture and is expected to meet a considerable demand at home and on the export market. It has been designed to handle metal or plastic preformed caps and to automatically place them on to bottles and other containers at a speed of up to 120 per minute. It is a self-contained machine with a section of feed on, and discharge conveyor, driven from the machine motor. The caps are loaded into an unscrambling hopper where they are automatically sorted and fed down a gravity chute. A selecting arm picks up a cap at the end of the chute and offers it under the capping chuck, which descends and grips the cap with three jaws. Further rotation of the machine causes the selecting arms to move away from the chuck. A filled bottle is then placed in position under the chuck by means of the feed wheel. The chuck then descends over the bottle neck and revolves, thus screwing the cap into the bottle, to any desired tension which is very easily adjusted. After capping the bottle is then discharged via a revolving plate, on to the discharge conveyor. During capping, the bottle is held in gripping jaws which keep it upright and prevent it from moving or turning when the cap is being screwed down. The jaws release, just before the bottle is discharged. The machine is quickly adjustable for various sizes of bottles and caps. It can be directly connected to a filling machine.

(*Continued on page 60*).

(Left) Cellulose acetate film is used for carton windows, and laminated with other films or foils, for sealed powder and liquid packs. (British Celanese, Ltd.)

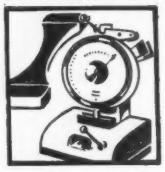
(Right) Fully automatic bottle-capping machine designed for use with plastics closures. (Albro Fillers and Engineering Co. Ltd.)

(Above) Polythene bottles with capacities ranging from 2 ounces to 5 gallons were shown by Cascelloid Ltd.



World's Industry Employs Plastics

MATERIALS and TESTING



Thermal properties of Teflon.—G. T. Furukawa and coll. investigated the thermal properties of polytetrafluoroethylene in an adiabatic-vacuum calorimeter. The effect of annealing and quenching processes on the heat capacity was studied. ("Journ. Research Nat. Bur. Standards," 1952/Oct./273.)

Petrol-resistant elastomer.—The plastics laboratory of the Minneapolis-Honeywell Regulator Co. investigated nitrile-type synthetic rubbers, and developed a mineral-filled material which was satisfactory in service. ("Materials and Methods," 1952/Oct./118.)

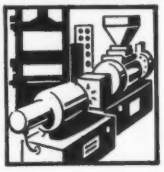
High-strength silicone has been developed by Connecticut Hard Rubber Co. Tensile and elongation properties are about double the best properties of usual silicone rubbers. This result was obtained chiefly through new compounding techniques with ultra-fine silica pigments. ("Materials and Methods," 1952/Oct./119.)

Boards of wood cuttings.—To counter the shortage of wood, boards of chipped wood with a suitable binder have been developed. The properties and production methods are described by A. Petz. ("Kunststoffe," 1952/Nov./391.)

Dielectric properties of plasticized p.v.c.—H. Voigt reports about investigations made at frequencies of 0.1 to 1,000 m/cs. per sec. with a special apparatus at temperatures between 20 and 80 degrees C. Some general conclusions on the influence of the plasticizer on the dielectric constant are drawn. ("Kunststoffe," 1952/Nov./395.)

Plastics Conference and Fair, 1952.—The complete December, 1952, issue of the German plastics journal is devoted to publication of the speeches and scientific papers given on this occasion. ("Kunststoffe," 1952/Dec./413-488.) **Thermal destruction of macro-molecular combinations.**—H. Hopff stressed that a knowledge of the decomposition products is of importance for the manufacturer, in particular when these contain unhealthy and corroding substances. **Problems of testing plastics.**—R. Nitsche pointed out that the rapid development and the manifold types have hitherto hindered considerably the development of systematic testing methods. Some hints for improvement were given. **Deformation of plastics.**—A. V. Bloom tried to demonstrate the inter-relationship between the structure of the macromolecules and the deformation properties of plastics. **Viscose behaviour of high polymers** depends mainly on temperature, pressure and shear stress. As the viscosity increases with the molecular weight, it can be used for determining the molecular weight itself.

PROCESSES : MACHINERY



Punching qualities of paper laminates.—Workers at Philips, Holland, developed a method whereby the hardness of laminated materials can be measured at usual punching temperatures. Investigations were made at various temperatures and pre-heating times to obtain best conditions for the punching. ("Kunststoffe," 1952/Nov./93.)

Production of coumarone resin.—The properties, production methods, as well as the polymerization process of coumarone resins, are described. ("Kunststoffe," 1952/Nov./403.)

Phenol moulding compound produced by Rogers Corp., Manchester, Conn., can be automatically preformed on a standard tabletting machine. Preforms can be held to close tolerances. ("Materials and Methods," 1952/Dec./145.)

Impact tester for plastics (produced by Machine Div., National Forge and Ordnance Co., Irvine, Wawen Country, Pa.), has three capacity ranges. Maximum clearance and open working space is provided. Izod or Charpy tests can be made; a separate hammer being provided for each capacity range. ("Materials and Methods," 1952/Dec./147.)

MISCELLANEOUS USES

A polythene milk valve solved the main problem on an automatic milk vending machine. It is operated magnetically without any moving mechanical parts. The valve measures and pours directly into a paper cup by gravity from one of two standard 40-qt. milk cans in the milk vendor. When the cans are empty, the valves are thrown away. ("Materials and Methods," 1952/Dec./114.)

Structural materials.—G. Hempel surveys the structural products recently exhibited at Dusseldorf, typical uses and trade names are given. ("Industrie-Anzeiger," 1952/Dec. 23/1257.)

Shipbuilding.—E. Vierhaus reports on tests and experiences in the application of plastics to shipbuilding. (Hansa, Vol. 89, 1952/Vol. 89/1953.)

Wire insulation by silicone rubber is reviewed by M. G. Noble. Properties and processing of silicone rubber as an insulating material are treated in detail. ("Wire and Wire Products," 1952/Oct./1064.)

Plastics in industry to-day.—W. Schack gives a survey of the major commercial plastics, outstanding new uses, and properties. ("Product Engineering," 1952/Oct./128.)

Lucite-bonded scintillation screens are rigid enough for portable alpha detection. Phosphor is pressed into a Lucite backing and subsequently coated with aluminium. ("Nucleonics," 1952/Dec./68.)

COATINGS and ADHESIVES

Synthetic - resin adhesives.—Some typical examples of the application of the Redux process for metal-to-metal and metal-to-non-metal joints are given, such as bonding clutch and brake linings, bicycle forks, window frames, porcelain insulators, etc. ("Machinery" (Lond.), 1952/Nov. 7/975.)

New adhesives.—K. Rose surveys the adhesives offered at present and subdivides them in: Rubber base, polyamides, epoxide resins, di-isocyanates, acrylics and silicones. ("Materials and Methods," 1952/Oct./132.)

Urea-formaldehyde coating compositions were prepared and compared by K. K. Sarin and S. L. Kapur. ("Journ. Scient. and Ind. Research" (India), 1952/Vol. 11/474.)

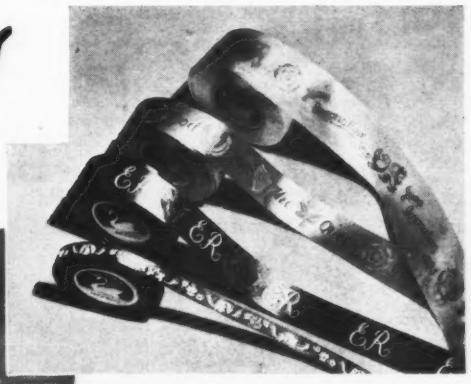
A quick-setting thermoplastic cement for general use (American Consolidated Dental Products Co., P.O. Box 2015, Philadelphia 3), requires no air for setting. It can be used with metals, wood, plaster, porcelain, stone, concrete and glass. Cement is said to be ideal for emergency applications. ("Materials and Methods," 1952/Dec./160.)

Recently developed materials are surveyed in an 18-page summary, amongst them a number of new plastic adhesives. etc. ("Machinery" (N.Y.), 1952/Nov./161.)

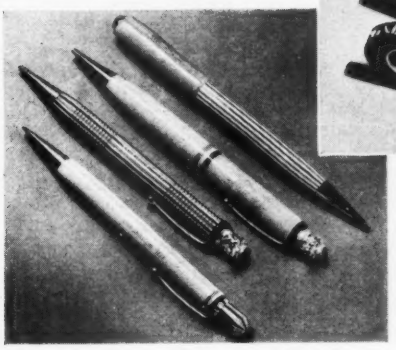
Curing of synthetic resin lacquers by infra-red radiation has been investigated by W. Bruegel and A. Vlachos of the laboratory of the Bad. Anilin and Soda Fabrik, Ludwigshafen. ("Farbe und Lack" (Hannover), 1952/Vol. 58, No. 11/475.)

Coronation Souvenirs

We present here a further selection of Coronation Souvenirs made in plastics materials.



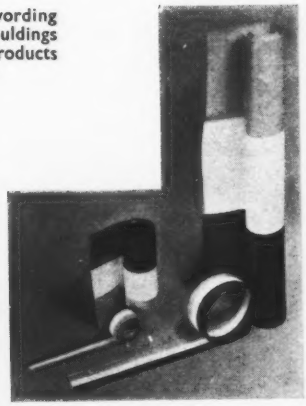
(Above) "Silsheen" ribbon, manufactured by Porth Textiles, Ltd., is a laminate of rayon yarn on Celanese acetate film, with Coronation motifs printed in multi-colours.



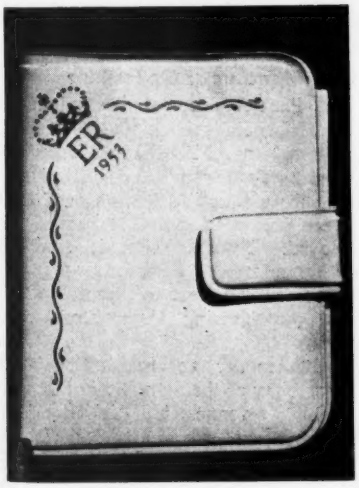
(Left) Several pencil fabricators use special designs of "Lactoid" casein rod manufactured by B.X. Plastics, Ltd., and sold by A. E. Goodeve, Ltd.

(Left) Optical effect of moulded polystyrene prisms show wording or the Queen's portrait at different angles of vision; mouldings and extruded rigid p.v.c. stand are made for K.B. Products (Epsom) Ltd., by British Moulded Plastics, Ltd.

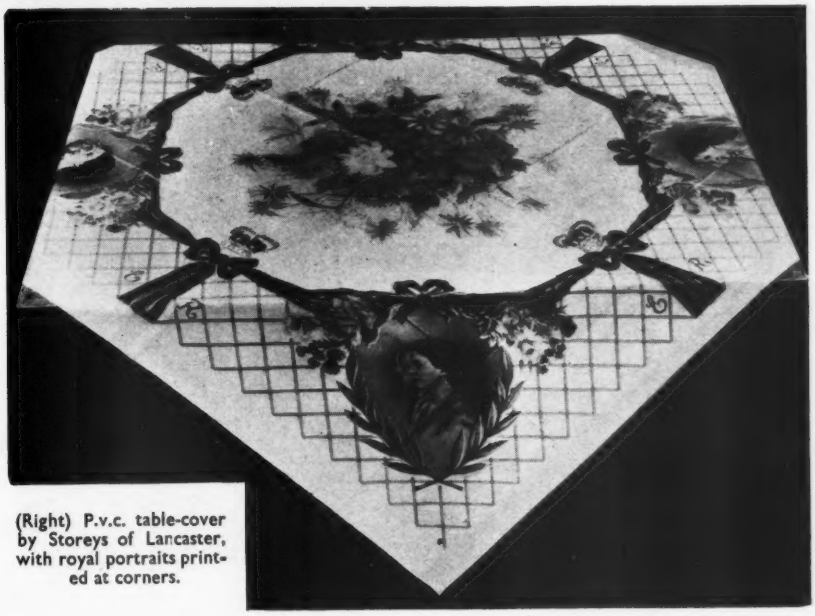
(Below) Polystyrene ornament brooches and lapel badges moulded and marketed by Pignon Plastics, Ltd., London, N.7.



(Above) Red, white and blue p.v.c. extrusions by Erinoid, Ltd.



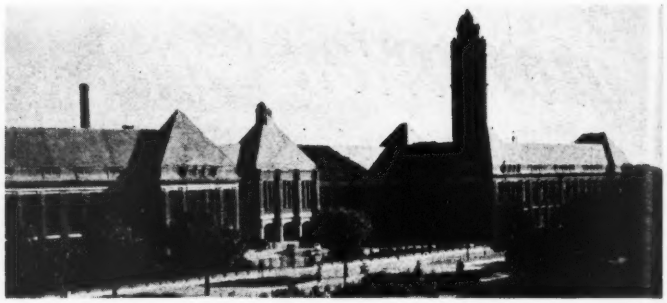
(Above) H.F.-welded ladies' purse, in p.v.c., with printed decoration, by Campden Plastic Products, Ltd.



(Right) P.v.c. table-cover by Storeys of Lancaster, with royal portraits printed at corners.

Plastics Research in Holland

A review of the work that is being carried out at the Plastics Research Institute, T.N.O., at Delft, Holland



SEVEN years ago Continental Europe, with the exception of neutral Sweden and Switzerland, faced a situation unparalleled in economic history. Either by forced production or by enemy action virtually complete industries were totally unfitted to meet the first essentials—to get people employed and to get money flowing again. What has in fact been achieved by the plastics industry in these seven critical years?

Visitors to the Continent invariably remark on the apparent progress that has been made, particularly in the use of the newer raw materials. That this is a fact is not however quite as remarkable as may first appear. In some respects the very devastation consequent upon the war has been instrumental in bringing the European plastics industry to the fore.

We in Britain expended our energies for over five years with one goal in view; the winning of the war. Wherever new materials were applicable they were used, but the overriding factor was always war production, and opportunity to contemplate peace-time possibilities was limited. As a result our conversion to peace-time conditions was of necessity a lengthy process. On the Continent, however, business men and technologists were able to rapidly survey the progress that had been made here and in America, select the ideas and materials most suited to their needs and to start virtually with a clean sheet. Hence the speedy employment of materials such as polystyrene, purchased in many instances against dollar loans.

It would of course be wrong to assume that this rapid growth has been good for all the countries concerned; the internal economy of many European nations is still in a parlous state. Against this, however, it must be accepted that a fundamental change has taken place on the Continent in a relatively short space of time.

For example, the establishment of Benelux has done much to fuse the interests of three countries dissimilar in race, language and industrial potential. Deeper than this is the realization on the part of business men of all countries that national differences of opinion cannot be allowed to stand in the way of economic progress and that artificial barriers such as existed before the war must be broken down to permit the easy flow of trade. This is particularly true of the plastics industry, which is in some respects fortunately free from traditional associations. A new industry, largely re-created in post-war years, it has had a unique opportunity to exploit the abnormal conditions obtaining since 1945.

These changes have been largely responsible for the growth of a number of associations and institutes, particularly the Plastics Research Institute, T.N.O., at Delft, Holland. It is interesting to study the nature of this organization which, whilst it has borrowed much from the pre-war experience of other institutes, has nevertheless had its character formulated by these post-war Continental European changes.

Planned originally during the war, the Institute is part of Holland's answer to the loss of her Asiatic empire. Shorn or her vast raw materials sources, and ill-equipped geographically to face the changing economic world, Holland has set out to sell her brains. Here she appears to have followed the pattern established by the Swiss and one that has paid handsome dividends.

Although the Institute is one of several, covering rubber, wood, shipbuilding, etc., it is because of its youth one of the most vigorous. Established in 1946, it is part of a technical service operated under State supervision and bearing in some respects a strong resemblance to our Department of Scientific and Industrial Research. The various Institutes, located all over Holland, are controlled by a central board and every effort is made to harness the resources of the Institutes to current Government economic policy. The system also provides for the ready interchange of information, scientists and technologists, so that Institutes with common problems can avoid duplication of work.

General view of testing department.

Structure of the Institute

The Plastics Research Institute comprises four main divisions; Pure Research, Applied Research, Patents and Documentation and Testing and Technical Advice. Including graduate scientists, assistants and engineers, some 180 people are employed. Each division is equipped with laboratories and requisite equipment and each has recourse to a central workshop, glass-blowing shop, stores and library.

Fundamentally the organization is the responsibility of the State but in fact considerable revenue is derived from industry. Apart from a monthly periodical "Plastica," for which the Institute is responsible, and which enjoys a surprisingly high circulation in view of Holland's size, the Institute's prime function is to assist the Dutch plastics industry. As may be expected, the establishment of a central

research centre promoted considerable discussion and even alarm in some circles. Industrial developments on the "secrets list" might be secrets no longer if placed in the hands of a central body. In practice, the system has been found to work satisfactorily and much of the initial opposition has been overcome, if only for economic reasons.

Pure Research

The pure research division is concerned primarily with work of a fundamental nature. Its staff have a common meeting ground with scientists of other nations and although its degree of profitability to the State must be measured on a long-term basis, there can be no doubt that with the great resources behind it this division will establish a prominent position for itself in the world of science.

Applied Research

In the field of applied research, the emphasis is upon technical developments. Ideas thrown up by the pure research division are tested at pilot plant scale where desirable, and in this way the Dutch industry has opportunity to take advantage of research normally too costly to be carried by itself. The Institute is empowered to take out patents and to lease or sell these to interested Dutch companies. Moreover, the industry itself can bring its problems to the Institute for solution. Located in vast rooms, for the building housed a German armaments plant during the war, are presses, extruders, calenders, testing machines and other apparatus beyond the reach of most individual companies. With the research and development plant at its disposal, it is able, at a fee, to have research carried out for it into problems of all kinds. A potential application of a specific material to a specific job can be evaluated in advance. If successful, many of the inherent difficulties will have been encountered and money will have been saved by virtually solving them before they emerge in commercial production. If unsuccessful the company concerned can think again.

Service to Industry

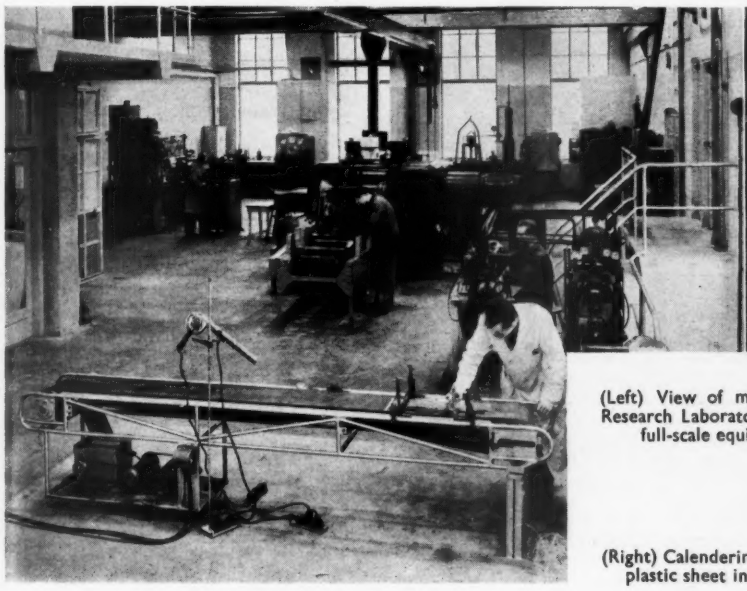
In addition, a service is operated which is designed to draw to the attention of the relevant companies information on the progress in their particular fields abroad. Apart from the actual abstracts of technical articles which are prepared, the service ensures that interested Dutch companies are fed with the latest facts, a valuable feature and one that is particularly useful to the smaller firm.

It will be seen that the Institute as a whole has been responsible for the building up of a fund of technical experience, of value not only to Holland but to other countries as well. It has been in the Government's interest, therefore, to encourage contact between the Institute and organizations outside Holland, by means of direct association, through representation at conferences and exhibitions, and by a travelling exhibition built by the Institute itself.

Substantially, and with due limitations, knowledge accumulated within the Institute, except where it falls within the scope of one or a number of contracts between the Institute and individual companies, is for sale, and thus it is that one European nation, for example, has sent technologists to work in Delft for lengthy periods of time, to study problems arising in its own plastics industry and to profit from direct contact with the technical developments taking place in Delft. The value of the Institute is not limited therefore to Holland—properly managed as it is, it represents a valuable addition to the national income. Moreover, the men who are trained at Delft and who subsequently work in other countries, be they Dutch or of other nationality, will consolidate the position of the Institute as the pre-eminent centre for research and development on the Continent.

Perhaps the organization nearest to the Institute at Delft in structure and purpose is the Mellon Institute in the U.S.A. The Dutch Institute serves as a more interesting equipment, since it occupies a unique position in Holland. Its future will be watched with the closest interest, as a new departure born of the changed conditions of the post-war years. At this stage it would perhaps be unfair to offer criticism particularly as six years is a short time in which to measure fully the results obtained so far. That both the Institute and the individual countries on the Continent have a long way to go before both can get the full benefit of each is beyond doubt, but it is of great significance, not only to the plastics but to all industries here and in America, to realize that our pre-war concept of a divided and uneasy Continental Europe no longer holds true.

We are perhaps for the first time seeing a Continent the western half of which is substantially united. The somewhat spectacular development in Holland is by no means unique except perhaps in size. All over Europe to a lesser or greater extent the importance of technical developments has been realized—the precursor to higher standards of productivity and quality—and bringing nearer the day when we and America will have to face the competition of a commercially, if not nationally, united Europe.



(Left) View of main Applied Research Laboratory, showing full-scale equipment.

(Right) Calendering of thermoplastic sheet in progress.

Improved Injection Moulding Equipment

Pre-plasticizing Unit for IMPCO Moulding Machine

A pre-plasticizing unit which can be fitted to the Model VF.822 plastics moulding machine manufactured by Improved Paper Machinery Corporation of Nahsua, New Hampshire, U.S.A., makes possible increases in the rate of production and improvements in the quality of mouldings produced. Finney Presses, Ltd., Berkley Street, Birmingham, 1, are the British selling agents for this machine.

THE IMPCO VF type moulding machine may be used for—

(1) Straight injection moulding of thermoplastic material.

(2) Injection-compression moulding of thermoplastic material.

(3) Compression moulding of thermosetting material.

(4) Plunger or transfer moulding of thermosetting material.

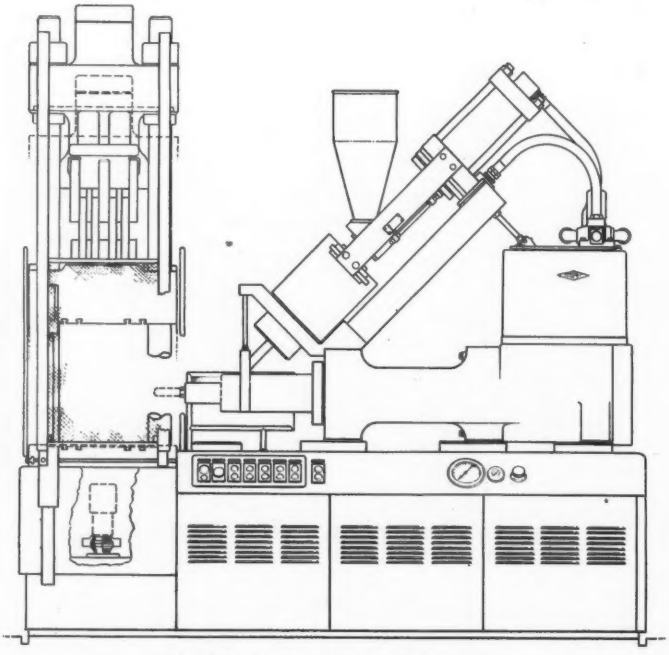
With the advent of the new IMPCO pre-plasticizer, available for all VF.822 models, a high increase in rate of production together with improvement of quality has been achieved.

The versatility of the machine is obtained through the use of a vertical clamping unit in combination with a horizontal injection unit. Contained in the vertical unit is a compression ram, which operates up through, but independently of, the stationary die platen. The horizontal injection unit combined with the pre-plasticizer is used to plasticize and introduce the material into the mould cavities. The compression unit is used in the moulding operation in a manner which assures positive application of the required moulding pressure. With this combination results are obtained that are beyond the scope of conventional machines. Shrinkage and voids on heavy sections can be eliminated, a most important factor when moulding nylon. Platen size and clamping pressure are sufficient to mould components with exceptionally large projected areas. As the moulds lie on the horizontal plane the machine is especially suitable for insert work. Mould adaptors are available for conversion of moulds as used on horizontal machines for use with the vertical clamp.

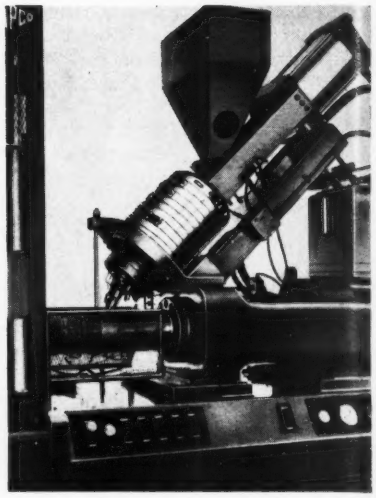
The principal components of the machines are as shown on the drawing below. They consist of two assemblies, the vertical clamping unit and the horizontal injection unit.

Clamping Unit Assembly

The fixed platen is secured to the four vertical tie-rods that are supported by the compression cylinder casting. The moving platen slides vertically on the tie-rods.



IMPCO VF.822 plastics moulding machine.



It is raised and lowered by a toggle mechanism, which is operated by a piston in the clamp cylinder casting. The clamp cylinder casting is secured to the upper ends of the four tie rods. The fixed and moving platens, the clamp cylinder casting, the toggle mechanism and the tie-rods are adjustable as a unit, to align the nozzle of the injection unit with the parting line of the mould. The clamping mechanism is also adjustable to provide for moulds with thicknesses varying from 8 ins. to 26 ins.

Compression Ram

The compression ram located under the fixed platen may be used for:—

(a) Injection-compression moulding.

(b) Follow-up compression on straight injection moulding.

(c) Transfer or plunger moulding of thermosetting material.

(d) Actuating gate shearing pins.

(e) Operating knock-out devices.

The upper end of the compression ram has a split coupling to which any desired fitting may be secured. The ram is actuated by a hydraulically-operated piston in the compression cylinder casting.

Clamp details:—

Clamping force	500 tons
Clamping stroke	10 ins.
Daylight opening—	
open—max., 36 ins.; min., 18 ins.	
closed—max., 26 ins.; min., 8 ins.	
Platens dimensions	
overall	36½ ins. by 30 ins.
between tie-rods	23½ ins. by 18 ins.
Ram speeds—closing	5 ins./second
—opening	5 ins./second

Compression unit details:—

Compression force	10, 50 or 100 tons
Stroke	5¼ ins.

Injection unit assembly

The table of the injection unit assembly consists of a base, which serves as a tank for the hydraulic oil, and a table top mounted on legs secured to the base. The injection carriage moves back and

forward on wear plates secured to the table top. The injection carriage carries the pre-filling tank, and other elements of the hydraulic system that operate the injection ram to which is secured the injection plunger. The pre-plasticizing unit is carried on top of the injection carriage and feeds into the heating cylinder from a hopper carried on the pre-plasticizer. The new IMPCO pre-plasticizing unit is available on all Impco models of 22 ounces or higher capacity. The unit pre-plasticizes at the rate of 150 lb. per hour and the plunger exerts a load of 15,000 p.s.i. on the material in the plasticizing chamber, which is externally and internally heated. The standard model has a water-cooled injection-feed plunger, worked in conjunction with the injection ram, which automatically meters the material from the hopper to the heating cylinder. The carriage is moved hydraulically until the nozzle is in contact with the mould, when the injection plunger forces the heated material into the mould cavity. Speed of injection can be varied to meet the requirements of different moulding conditions.

Mounted on the tank top under the table is the hydraulic power unit. This consists of a 20 h.p. electric motor driving high- and low-pressure pumps and combination valve units. This equipment operates the moving platen, the compression ram, the injection carriage, pre-plasticizer and the injection plunger. On the operator's side of the table top is the control panel on which the various push-buttons for manual operation or automatic cycling are mounted, together with an emergency stop and pump motor starter. A visual temperature recorder for the hydraulic system, pressure gauge and pressure regulator are mounted adjacent to the panel. The operation of the machine may be controlled manually by pressing the push buttons controlling the clamp, carriage, injection and compression circuits. For automatic cycling, closing of the safety gate starts the cycle.

Pre-plasticizing unit details:—

Pre-plasticizing capacity (polystyrene)	150 lb. per hour
Pressure on material (1,000 p.s.i. pump pressure)	15,000 p.s.i.
Heating—internal and external.	
Heat control by two proportioning instruments.	
Hopper capacity	150 lb.

Details of the Injection Unit:—

Rated injection capacity (polystyrene)	80 oz.
Diameter of injection plunger	4⅛ ins.
Diameter of injection piston	16 ins.
Pressure on material (1,000 p.s.i. pump pressure)	14,750 p.s.i.
Heat controls	3 zone proportioning instruments
Ram speeds: forward	1 in./second
back	1.2 in./second

Control Panel and Safety Devices

This is a separate unit for mounting adjacent to the machine. It contains the Wheelco Capacitrol temperature control instruments, timers, main control switch, heater switches, compression and plunger selective switches.

The machine is equipped with both hydraulic and electric safety devices, which are so designed that the clamp will not close until the proper point in the cycle of the machine has been reached, and the safety gate closed.

Increased Moulding Capacity for PECO Machines

THE importance of homogeneous plasticization of thermoplastic materials for injection-moulding difficult components—for instance, large area, thin-wall mouldings—has prompted Projectile and Engineering Co., Ltd., Acre Street, Battersea, S.W.18, to carry out experiments to improve the plasticization of their complete range of injection moulding machines. They report that they have been successful in increasing the plasticizing capacity of these machines. Improved plasticizing efficiency has been achieved in the "Peco" plasticizing unit by the careful co-ordination of all the many conditions favourable to thermal efficiency and streamlined flow. The chamber is provided with a high heat transfer surface per unit volume of material, and the heating zones and the relative thermo-couple positions have been arranged to provide a high progressive heat transfer to the plastic material during its passage through the chamber, at the same time ensuring, however, that at no point do excessive temperature and subsequent material decomposition occur.

This improved rate of plasticizing, together with the high rate of injection and adequate platen area locking capacity and mould opening stroke of the machines, has led the way to an increased shot capacity rating, enabling fuller use to be made of the machines.

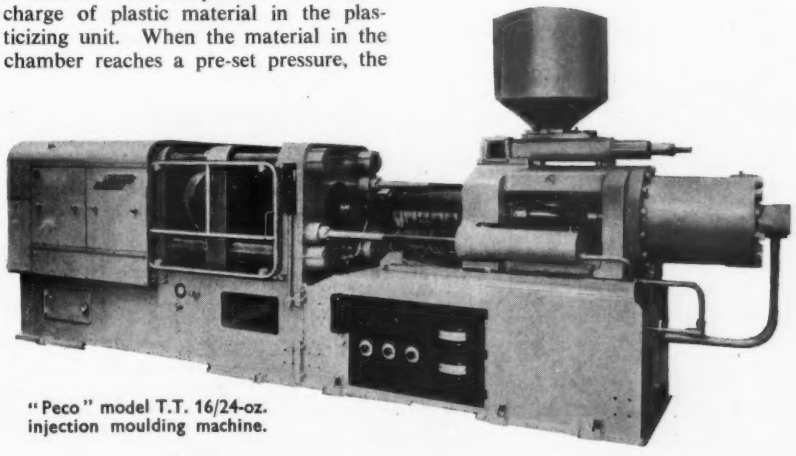
Double Feed

By adopting a system of double feed per shot, it is now possible to use the "8-oz." machine for high-speed continuous production of mouldings up to 10-oz. and the 16-oz. machine for mouldings up to 24-oz. (polystyrene). The system of double feed is simple in operation and entirely automatic and does not increase the cycle time required for a given moulding. The process is as follows:—

After the cessation of the injection period, that is, during the cure period, the injection plunger fully retracts and then re-advances to compact an additional charge of plastic material in the plasticizing unit. When the material in the chamber reaches a pre-set pressure, the plunger returns to the fully retracted position—an operation carried out in a very short time, which is always less than the cure period required for a moulding of the increased capacity.

It will be evident then, as previously stated, that there is no increase in the overall cycle period. Should, however, the cure-timer be set for period control less than is required for the double feed action, it becomes inoperative, the mould opening being initiated by the return of the injection plunger to the fully retracted position. The selection of the double feed is made operative by the depression of a toggle switch.

(*Continued on p. 57*)

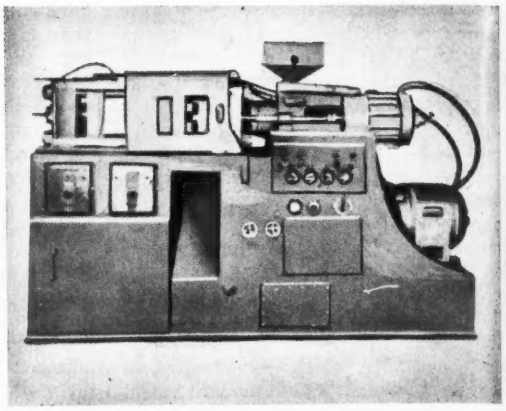


"Peco" model T.T. 16/24-oz. injection moulding machine.

Developments in High-speed Automatic Moulding Machinery

By F. C. MEANS

This paper, published here by courtesy of the Society of Plastics Engineers, Athens, Ohio, is reprinted from the "S.P.E. Journal," November, 1952. It discusses the advantages of fully automatic moulding machines, with particular reference to the machine manufactured by Fellows Gear Shaper Co., Springfield Vt., U.S.A., and describes several design features and techniques for the successful operation of this method of production.



The Fellows machine, such as is described, producing ten shots per minute.

MOST moulders in any gathering, remembering costly moulds which have been badly damaged and production held up for days because an operator went to sleep on his feet for a split second, listen with only half an ear when somebody starts talking about automatic moulding. Anyone can probably think of forty-nine reasons why automatic moulding can't or won't work—but there is one good, strong, and sufficient reason why it can and must work—the profit dollar.

Any method of moulding which can increase the production per dollar of moulding machine investment and reduce labour costs, is bound to have a favourable effect on profits. For this very compelling reason, we have believed that it was worth while to examine the objections to automatic moulding, considering them as limitations to be surmounted for indications of how machines can be developed and techniques acquired to make automatic moulding possible.

As machine manufacturers, we know that most of the developments in automatic moulding depend on what the moulders do with the equipment after they get it into the plant—what ingenuity the moulder tool engineers, or mould makers show in solving the multitude of problems that surround each individual injection job.

Are sprues necessary?

As a case in point, consider the sprue in an injection mould. Why this relic of poor plasticizing and improper nozzle design still lives on to cause sticking problems, requires extra stroke length in the press and often adds seconds to cycle time is a question more and more moulders are beginning to ask themselves. Fig. 1 shows an extension nozzle, heat controlled, which extends to the parting line of the mould and greatly facilitates automatic moulding—to say nothing of saving material. This design can be used equally well on single- or double-parting line moulds with very little loss of effective moulding area. In some cases it has also been used successfully into a single cavity, where the end of the nozzle actually formed a part of the cavity. The trade mark was on the end of the nozzle. This development has been made practical by machines employing a hydraulically actuated mobile nozzle slide which carries the whole injection mechanism and heating cylinder directly to the mould.

Automatic Degating

Another development which has facilitated automatic moulding, particularly on materials with some flexibility, is automatic degating. In Fig. 2, are two examples of this as applied to a single-parting line mould. In the first case the gate goes under the parting surface while in the second a two-stage knock-out is employed, ample knock-out travel and a fairly flexible pattern of knock-out holes in the machine platen are of considerable assistance here.

The automatic degating possible with a multiple parting line or three plate mould is well known, but automatic operation of such moulds can also be achieved by use of back gating into the cavity and combining the knock-out system with stripper action or by employing a front stripper with the special nozzle on the mobile slide mentioned in the first case.

Still another problem solved by ingenuity concerns jobs where, due to design, the shot may have a tendency to hang on the knock-out pins. Here, as illustrated in Fig. 3, cam-actuated knock-out plate-stops on the machine compress springs in the mould knock-out mechanism until the very last increment of opening stroke, at which time the stops are lifted clear and the springs in the mould retract the knock-out mechanism. Auxiliary cylinders, either air or hydraulic have also been employed for this purpose.

Controlled "door-open" time

One of the important aspects of moulding automatically, which is often overlooked, is the elimination of a variable "door-open" time which is almost impossible to overcome completely so long as the actions of an operator form a part of the cycle. Injection moulding is essentially a continuous process dependent for

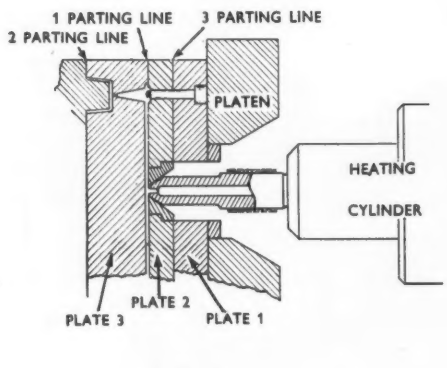


Fig. 1.

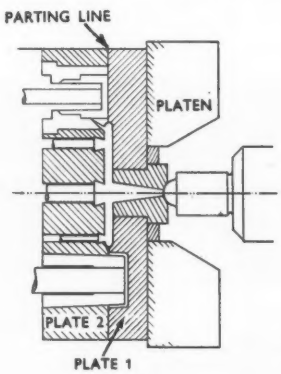


Fig. 2.

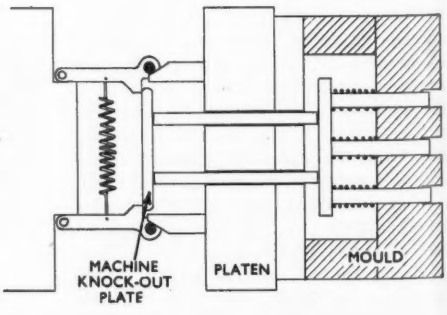
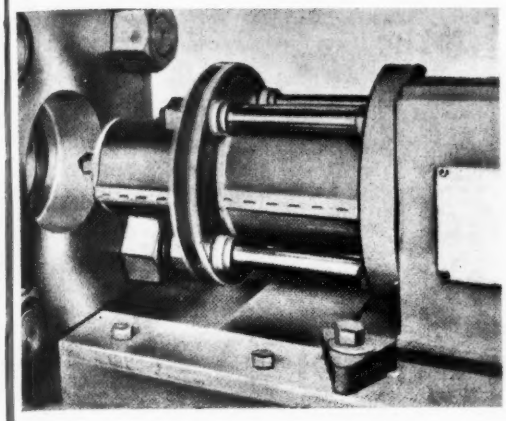


Fig. 3.



Close view of heating cylinder on mobile nozzle slide, greatly facilitating use of special design extension nozzles.

its success on the uniformity of the time, temperature and pressure variables. In addition to the time lost each cycle because of opening and closing a door, considerable variation in quality can result as regards flash, short-shots, non-uniform-weight shots, etc., due to the erratic element introduced by an operator.

Accurate incremental time controllers for each element of cycle, including delay time to allow the shot to clear itself from the mould, are built into the machine and greatly facilitate the initial adjustments necessary to get the machine on cycle. Control for injection pressure, including dual-pressure injection in some cases, is also provided. Temperature controllers built into the machine make for quick and easy changes to this most important variable without having to move from the operating station.

To facilitate speed of clearing the shot from the mould, connections are provided for air blasts, actuated by an air valve or switch as the press opens. These same connections can be used on air lines directly to the mould in cases where the parts must be blown from the cavity.

Adequate provision for mould temperature control is, of course, a must for good automatic moulding. While water and drain connections for the mould and also for cooling the front platen are provided, temperature control is recommended.

One of the questions which worries potential users of automatic moulding machines is, what happens to the mould when a shot gets caught between the mould halves—and no operator around?

There will be no damage done to the mould even if it is soft steel, or " as-cast " beryllium, if the machine is equipped with a low-pressure closing safety device and is being run on fast automatic cycles.

In the first place, the mould faces come into contact under very low pressure until such time as a microswitch, sensitive to 0.005 in. to 0.010 in., is made, at which time the machine goes back to high pressure, the toggles straighten out and the moulding cycle begins.

If a piece does get caught, it usually has sufficient heat in it to flatten out somewhat and distribute the low pressure of the initial closing stroke over a wide enough area as to be well within the compressive strength of the mould materials.

An actual job might serve to illustrate this. The shot consisted of a twelve-cavity Christmas item of about 0.040-in. wall. Total weight of the shot was about 1¼ ozs. The mould was of three plate construction without a sprue. The runners were connected with thin supporting webs to keep them from curling to the point where they would not drop. Actual moulding time was ten shots per minute. Material was polystyrene, moulded at the rate of 47 lb. per hour.

Occasionally a shot would stick, but result in no damage to the die. The machine was provided with an overriding timer set for slightly longer than the full cycle. Any interruption allowed it to time out and light a signal light or ring a bell to attract the attention of operating personnel kept busy in loading hoppers, collecting and regrinding scrap.

In this case it was not necessary, due to the thin wall section, to blow the parts into a water bath to harden them. This can be, and is often done, on heavier section parts where a disproportionate amount of the machine time would otherwise be employed in cooling.

We have run into some objection to blowing parts into water, such as water-spotting or cracking and crazing, particularly upon later applications of inks or paint. The use of a small amount of detergent appears to take care of the spotting objections but the combined efforts of ink and paint chemists have been required to run down contamination or other constituents in hard water that caused incompatibility with the inks.

There are, of course, certain jobs where due to dimensional tolerances or other quality requirements, longer cycles must be run. These same machines can mould nylon gears to thousandths on a 40-sec. cycle or run quality control checks for one of the country's largest plastics material manufacturers in their laboratories making tensile test specimens and colour and clarity chips, where as many as 40 to 50 colour changes in twenty-four hours are required.

Some of the latest developments in high-speed automatic moulding machinery are:

Conclusions

(a) A new appreciation of high-speed operations up to 10 cycles per minute.

(b) More plasticized material per hour.

(c) Safety and signal devices on the press closing stroke.

(d) Mobile nozzle slide to permit " sprueless moulding."

(e) Air blast connections for rapid ejection.

(f) Refinement of controls.

INCREASED MOULDING CAPACITY FOR PECO MACHINES

(*Continued from p. 55*)

Smaller Models

On account of the difficulty of obtaining increased shot capacity by double feed on smaller models, the " Peco " H.L.2 machine is supplied with either a 2-oz. or 3-oz. plasticizing unit, and again the T.T.4 machine is supplied with a 4-oz. or 5-oz. plasticizing unit, according to requirements. A greater displacement in the case of the 3-oz. and 5-oz. machine is obtained by an increase in diameter of the injection plunger. The general specifications of the 3-oz. and 5-oz. machines, as far as platen area, mould closing stroke, locking pressure, maximum die-height and plasticizing capacities are concerned are identical with those of the 2-oz. and 4-oz. machines respectively. Therefore, whilst these machines can mould the majority of shots up to 3-oz. and 5-oz. capacities, there may be a number of difficult mouldings where the limitations mentioned above would have to be carefully considered.

Details from the Specification.

		Type T.S. 8/10 ozs.	Type T.T. 16/24 ozs.
Volume moulded per shot (maximum)	(Single feed)	13.3 cu. in. (218 cm.³)	26.5 cu. ins. (434.3 cm.³)
	(Double feed)	16.7 cu. in. (274 cm.³)	40 cu. ins. (655.5 cm.³)
Weight moulded per shot (Polystrene)	(Single feed)	8 oz. (226 gm.)	16 oz. (453.59 gms.)
	(Double feed)	10 oz. (284 gm.)	24 oz. (680.38 gms.)
Plasticizing capacity		60 lb./hr. (27.2 kg./hr.)	85 lb./hr. (38.55 kgrms).
Rate of Injection		14.8 cu. in./sec. (242.5 cm.³/sec.)	21.6 in.³/sec. (353.92 cm.³/sec)
Minimum time cycle	(Single feed)	10 secs. (10 secs.)	15 secs. (15 secs.)
	(Double feed)	12 secs. (12 secs.)	20 secs. (20 secs.)

New Productions

Pneumatic Door Buffer

As will be seen from the illustration, the device produced for Sarjent's Tool Stores, West Street, Reading, by Insulators, Ltd., Edmonton, London, N.18, involves complicated design. The moulded parts consist of cap and body; the metal plunger is backed by a seal and is spring-loaded. A small screw in the cap controls the air exit and thus the buffering action. From the moulding viewpoint, the curvature on the body, the end of which is threaded to take the cap, called for skilful design. The unit is moulded in black general-purpose phenolic powder.

Polystyrene Capacitors

We understand that Suflex, Ltd., 55, Baker Street, London, W.1, have laid down a production line for the manufacture of capacitors employing polystyrene film. The special characteristics of the new capacitors will greatly interest designers in all branches of the electronics industry. Suflex, Ltd., are well known as manufacturers of flexible insulating sleeving and they are fortunate in being able to call on the manufacturing experience of the continental technical experts responsible for the initial development of the new component. The remarkable insulation resistance of these capacitors, excellent stability and low power factor make them eminently suitable for the most critical applications.

Hitherto, the low operating temperature of polystyrene capacitors has been a serious limitation. This has been overcome by Suflex, who rate their capacitors at +85 degrees C. for continuous operation, and have in fact been granted Type Approval by R.C.S.C. on their range to Joint Service Category 40/85 (−40 degrees C. +85 degrees C.).

The present range at 500 volts D.C. working covers 33 Pf. to 4,700 Pf. at tolerances of ±2 per cent. and ±10 per cent. Some idea of the very modest space requirements of these capacitors is conveyed by the fact that the largest measures only 10 by 32 mm. and the smallest 6 by 18 mm.

The application of polystyrene film, which ensures a degree of uniformity essential to such a product, has been encouraged by the cost of high grade mica.

Food Mixer

The photograph shows a new device of Danish origin which, it is claimed, greatly facilitates mixing in the kitchen. It is designed specially for cake mixing, and is moulded in white melamine, although the inventor intended that it should be made in shock-resistant styrene. We have been requested to publish the photograph in the event that a British organization might be interested in manufacturing the device under licence.

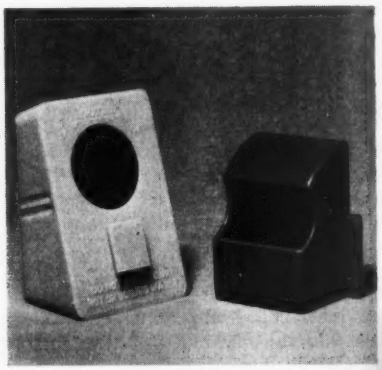
Folding Shopping Bag

Manufactured from satin-finished p.v.c. sheet, in various colours, are ingenious shopping bags which can be folded to a size a little larger than a spectacles case. When opened out, the bags are commodious and of strong construction.

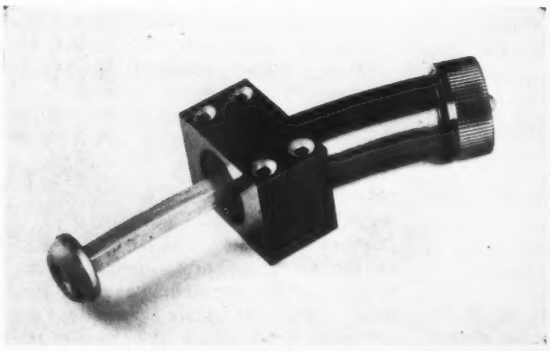
Having an all-welded (high frequency) construction, the bags can be submitted to severe wear. The handles consist of three sheets of p.v.c. welded together; the handles also provide the base for press fastener studs employed when the bags are folded. Produced by Camden Plastics Products Ltd., 186, Camden Hill Road, London, W.8.

Bird Cage Feeder

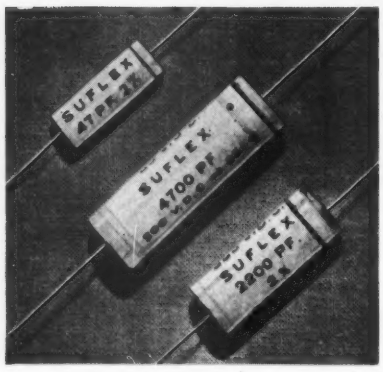
Manufactured by the Mentmore Manufacturing Co. Ltd., 1, Bradley Road, Wood Green, London, N.22, the Genykage Bird Cage Feeder is injection moulded in polystyrene. Durability and wide range of attractive colours are two of the factors which influence the choice of material to manufacture these accessories. Great care is taken in cementing the component mouldings.



Bird cage accessories.



(Above) Pneumatic door buffer.



(Left) Polystyrene capacitors.

(Above) Food mixer.

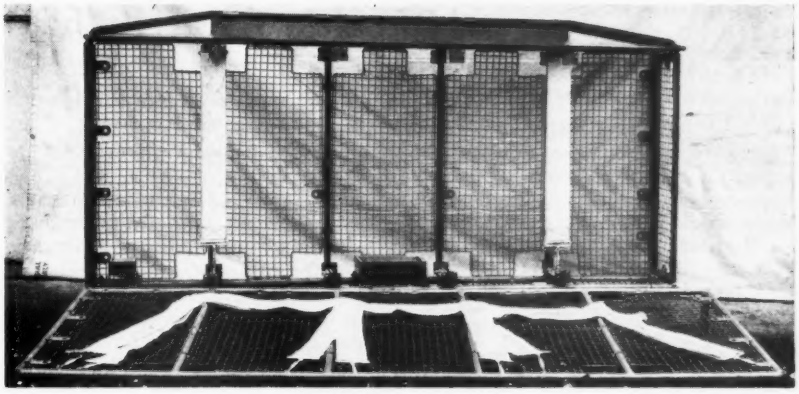
(Above) Folding shopping bag.

Cradle for Aircraft Wing

The protection of costly equipment is a major problem to the Services. Apart from the possibility of a lengthy period of storage under adverse conditions, such equipment must be adequately guarded from damage during transit and, in the case of the Royal Navy, whilst at sea.

As a contribution to the solution of these problems, Export Packing Service, Ltd., Imperial Buildings, 56, Kingsway, London, W.C.2, has developed the protective package, illustrated right, for aircraft wings. The main structure is of tubular steel which provides the framework for stout wire mesh. The whole structure is collapsible so that when finished with it can be stored away in the minimum of space, of great importance in aircraft carriers, and be used again.

The wing itself is suspended within the cradle by means of nylon webbing, and is thus held clear of contact with the wire meshing. By this means, wings are protected from damage at all stages until they are ready for use. Nylon has been chosen for this application because of its shrink-proof properties and high strength.



Cradle for aircraft wing.

New Moulded Window Display

This stylish counter or window display stand for " Bathjoys " is now available from Reckitt and Colman, Ltd., 40, Bedford Square, London, W.C.1. Compression moulded in one piece by Lorival Plastics from paper-filled urea material, the stand is extremely rigid yet without heavy sections. The colour selected was cream and the recessed lettering, filled in with green wax, provides a striking contrast.

Multi-way Cleats

A new method of supporting cables, tubes and pipe lines has been introduced by Hellermann, Ltd., of Crawley, Sussex. Moulded from Helvin P.V.C., the cleats are resistant to acids, alkalis, oils, and unaffected by light oxidation. Mouldings in Neoprene are also manufacturers for use where extreme temperatures are involved.

The use of Hellermann cleats simplifies the wiring installations of switchboards, control panels and sub-stations. They can also be used to great advantage for supporting pipe-lines in aircraft. The cleats are available in 16 standard sizes to accommodate a wide range of cables and pipes and are shaped so that they slide easily into correspondingly shaped metal channelling.

It is claimed that the cleats eliminate chafing of cables or pipes, provide for neat installation and eliminate the necessity for the cutting of cables to length before installation.

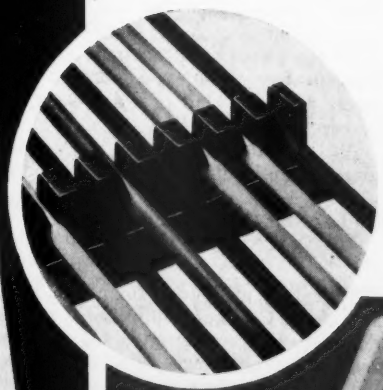
Conductors are not handled several consecutive times in front of a panel. A thumb push and they are firmly and securely held without being crushed or damaged.

Kitchen Accessories

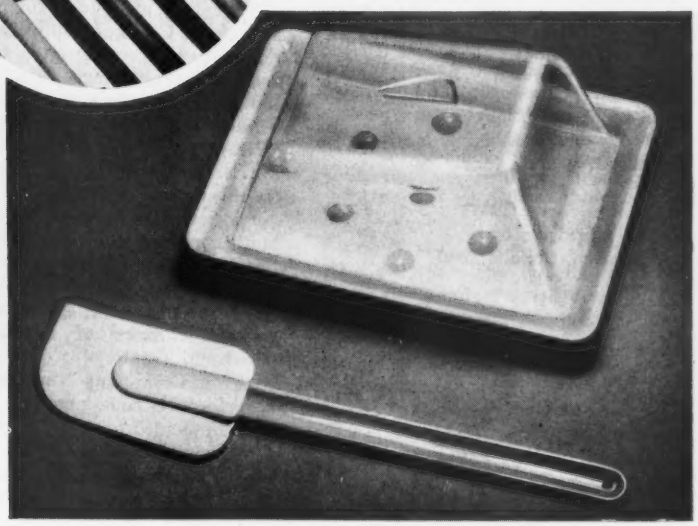
Polystyrene is employed in the manufacture of the attractive cheese dish photographed below. The base is of cream opaque material, the lid being transparent for visual inspection of the contents.

In the same range is an ingenious dough scraper the handle of which is moulded in polystyrene. The blade, made of polythene, provides the necessary flexibility to traverse the curvature of basins. Because of its non-toxic properties, polythene is ideal for applications where food is involved. These accessories are manufactured by Mendle Bros. Ltd., Station Terrace, Pontygwaith, Rhondda, Glam.

(Above) Window display for bath salts.



(Left) Multi-way cleats



(Right) Cheese dish and dough scraper.

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Pulley Wheels

SIR,—We are wondering if you could help us in contacting a firm of plastics moulders who are likely to manufacture pulley wheels 1 in. in diameter.

THE MERCHANT ADVENTURERS OF LONDON, LTD.
43, Portland Road,
London, W.11.

Laminated Fabric Moulding

SIR,—We note on page 358 in the December issue of "Plastics" that a landing lamp bracket is described. We are pleased to send one of these brackets to you. This bracket was produced by

us during the war years and is an exceptionally interesting example of just what can be achieved in laminated fabric moulding.

THE BUSHING CO., LTD.
Queensway,
Team Valley Trading Estate,
Gateshead, 11.

Hollow Plastic Spheres

SIR,—We require a quantity of brilliantly coloured hollowed balls of $\frac{5}{8}$-in., 1-in. and $1\frac{1}{4}$-in. diameter produced from a thermoplastic material, and shall be glad to learn whether you can advise the name and address of a moulder who might have tools available for this work. The tool would presumably produce half-mouldings which could be cemented together.

DAWE INSTRUMENTS, LTD.
130, Uxbridge Road,
Hanwell, London, W.7.

Scrap Nylon

SIR,—We are writing to inquire if you can put us in touch with any firms who buy the following materials: Nylon turnings, scrap nylon from mouldings, p.v.c. cuttings. Regular quantities can be offered.

FENNY BROTHERS.
Stockton-on-Tees,
Yorkshire.

Printing on Polythene

SIR,—We thought you would be interested in our new process of permanent printing on polythene containers. Undoubtedly you are aware that printing on polythene has been an extremely difficult problem but, after several years of constant research and experiments, we have overcome this problem. The enclosed sample will easily stand the well-known Scotch tape test and is impervious to most spirits and liquids.

A separate company called Polyscript, Ltd., has been set up to undertake the printing on our "Poly-Tainers," as well as on other polythene products manufactured by us or by other companies. Undoubtedly, this success of printing on "Poly-Tainers" and polythene in general will be of interest to a great many of your readers.

INDUSTRIAL APPLIANCES, LTD.
21, Grosvenor Street,
London, W.1.

Informative Labelling

SIR,—In your editorials of "Plastics," December, 1952, you agree with Mr. T. L. Birrell that "informative labelling" should not include the chemical names of the plastics employed in making the goods. I think this point of view is not quite right. People do not ask for textiles, but for goods made of silk, cotton or wool. Furthermore, if you wish to buy wood, you want to buy surely a special kind of wood—oak, fir or beech, and so on.

As the different kinds of plastics material are as different from each other as silk is from cotton or oak from fir, it seems to be obvious that the chemical name should be included in some way or another in the "informative labelling" in order to design the plastic type used. Perhaps this could be done in an appropriate short way, for instance, "Acrylic" for polymethylmethacrylate or "Vinyl Plastic" for p.v.c. If the customer does not understand these denominations, it will be up to the plastics industry to enlighten the public in this respect; it can easily be done by sensible and good "informative labelling."

A. REVERDIN,
Lonza Electric and Chemical Works, Ltd.
Basle,
Switzerland.

Extruders for Plastics

SIR,—We shall be obliged if you can assist us with information as to where we can obtain a plastics extruding machine suitable for extruding small-diameter cellulose acetate rods and tubes. Would you also kindly furnish us with the names and addresses of manufacturers or agents who could supply injection moulding machines.

BRISTOL REPETITION, LTD.
Feeder Road,
Bristol, 2.

Lacquer for Playing Cards

SIR,—Would you be kind enough to put me in touch with British manufacturers of plastic lacquer suitable for playing-cards.

L. G. THORESEN.
Tordenskjoldsgt 6b,
Oslo, Norway.

NATIONAL PACKAGING EXHIBITION

(*Continued from page 49*)

Two of the exhibitors (John Dale, Ltd., and Plastic Closures, Ltd.) showed a wide range of compression moulded closures and similar mouldings. Plastic Closures, Ltd., is a subsidiary company of Metal Closures, Ltd., and has recently been formed to take over a moulding plant at Maidenhead, which is specially equipped for this type of production.

Plastics materials not only provide bottle caps, they are also utilized in liners for sealing these caps. The materials employed are Bakelite's Vinylite coated on paper, polythene laminated to paper and loose discs of either p.v.c. or polythene.

Cushioning Materials

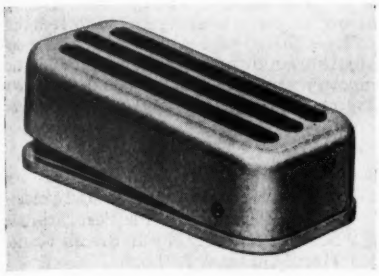
Preformed containers of a resilient nature moulded to fit the contours of the components to be packed, were shown by two manufacturers: Expanded Rubber Co., Ltd. (Rubazote expanded rubber) and Pontefract Box Co., Ltd. (Resil bonded fibres). The expanded plastics such as foamed urea formaldehyde and foamed polystyrene would appear to have great potentialities in the field, as was demonstrated at the recent German Plastics Exhibition, but no plastics of this kind were shown at the Packaging Exhibition at Olympia.

Miscellaneous Machines

Machines for bag-making, labelling and printing, were shown by many manufacturers. Of particular interest were the drinking straw wrapping machine, using Pliofilm (Lerner Machine Co., Ltd.) silk screen printing machines (Dubuit Machines, Gayler and Hall, Ltd.) and labelling machines employing a new method known as thermoplastic labelling (Rawsons Labelling Machines, Ltd., G. D. Peters and Co., Ltd.).

PRODUCTION NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes



A NEW FOOT SWITCH.—The H. G. Poxon Engineering Co., 1, Northolt Road, Harrow, has issued details of a new switch, Model 523, suitable for heavy workshop duty. The switch measures 8½ ins. by 3¾ ins. by 3 ins. and gives minimum obstruction on the floor. The switch cover serves as the pedal, and the switch is fitted with rubber feet which can be screwed to the floor. The switch mechanism is rated at 20 amps. at 250 volts A.C./D.C. and has a toggle action with quick make and break wiping contacts and can be supplied either single pole or double pole. An alternative micro switch mechanism can be fitted for light currents, A.C. only. The surface has a durable silver-grey, "hammered" finish stove enamel. The terminal block has an earthing terminal and is readily accessible for wiring and a cable grip is fitted for taking T.R.S. flex of widely varying sizes.

FACTORY EQUIPMENT EXHIBITION.—Horticultural Hall, Westminster, S.W.1, March 23-27, 1953. The National Factory Equipment Exhibition, which will be opened at the Royal Horticultural Hall, London, next March, will be the first of its type to be held in Europe. The principal object in holding the show is to stimulate the interest of directors and factory managers in modern equipment designed to increase efficiency in industrial activity, and contribute to the safety and welfare of workers.

BRITISH INDUSTRIAL PLASTICS, LTD.—We have received a copy of the technical leaflet CR7, dealing with the Beetle Resin BE 660. A butylated urea formaldehyde resin, it is designed for use in the formulation of high quality stoving and coal curing lacquers. Properties are as follows:—

Colour	...	Water white
Solvent	...	Xylol and Butanol
Solid content	...	53±2 per cent.
Specific gravity	...	1.02 approx.
Acid value	...	1-1.5.
Viscosity at 77° F. (25° C.)		7-15 Stokes V-X Gardner-Holdt 11-12A P.R.S. bubble tube
Flash point	...	80° F.

BERYLLIUM SMELTING CO. LTD., announce that the Sheffield Smelting Co. Ltd., 95, Arundel Street, Sheffield, 1, is prepared to cast Beryllium copper moulds for the plastics industry.

MOULDERS' PLANT CAPACITY.—The British Plastics Federation have given us their permission to publish the following summary of moulders' plant capacity for 1951 and 1952, based on the information collected annually by the Moulders' Group:—

	1951	1952
Compression Moulders	102	96
Injection Moulders	78	79
(a) COMPRESSION MOULDING CAPACITY		
Total number of presses.. ..	3,535	3,512
Total capacity of presses (tons)..	292,195	293,087
Number of Presses of Various Capacities		
Up to 25 tons	1,010	972
26 to 50 tons	843	844
51 to 100 tons	1,136	1,155
101 to 150 tons	251	238
151 to 200 tons	87	95
201 to 250 tons	76	76
251 to 300 tons	18	17
301 to 350 tons	48	48
351 to 400 tons	8	8
401 to 450 tons	3	4
451 to 500 tons	17	17
501 to 1,000 tons	24	24
1,001 to 1,500 tons	11	11
1,501 to 2,000 tons	3	3
	3,535	3,512
(b) INJECTION MOULDING CAPACITY		
Total number of presses.. ..	743	763
Total capacity of presses (oz.) ..	3,039	3,430
Number of Presses of Various Capacities		
Up to ½ oz.	66	61
½ to 1 oz.	105	107
1 to 2 oz.	125	127
2 to 3 oz.	120	117
3 to 4 oz.	113	128
4 to 5 oz.	12	9
5 to 6 oz.	39	45
6 to 7 oz.	8	5
7 to 8 oz.	109	124
8 to 12 oz.	34	4
13 to 20 oz.		13
21 to 32 oz.	7	15
33 to 40 oz.	1	2
41 to 50 oz.	3	3
51 to 75 oz.	1	3
	743	763

G. AND E. EQUIPMENT AND CONTRACTS LTD.—Pages 343 and 366 of the December issue of "Plastics" for 1952 made reference to productions of Fordham Pressings Ltd., in the course of which it was stated that G. and E. Equipment and Contracts Ltd., was a subsidiary concern. We are asked to state that G. and E. Equipment and Contracts Ltd., are associated with, and not a subsidiary of, Fordham Pressings Ltd.

KRILIUM, the new soil conditioner, is now in full production at the Newport, Mon., factory of Monsanto Chemicals, Ltd. The product is based on a vinyl acetate—maleic acid copolymer and is not the polyacrylic acid product announced at the beginning of 1952.

The advantages claimed for the use of Krilium include increased water penetration and availability to roots, easier soil working, and very ready availability of air. The product will be marketed by Monsanto (Soil Conditioners), Ltd., the newly formed wholly owned subsidiary of Monsanto Chemicals, Ltd., and will be known as the Merloam formulation.

A NEW SERVICE.—Designed for business men without London offices the Piquet Service of 41, St. Andrew's Hill, London, E.C.4, has been inaugurated by Mr. B. C. Kivell and Mr. D. N. King.

THERMOCHROMS AND THERMOCOLOURS.—R. H. Cole and Co., Ltd., announce that they have the concession for the plastics and surface-coating industries for a range of temperature indicators manufactured by A. W. Faber of the Badishe Anilin ü Soda Fabrik, of Germany. The indicators are designed to change colour at predetermined levels of temperature. Thermochroms are in the form of crayons, which can be applied to the particular apparatus under test. Thermocolours, supplied in powder form, are soluble in industrial methylated spirits and can be applied by brush to give an adhesive paint film.

PECO PRESENTATIONS.—The recent celebration of the Projectile and Engineering Co., Ltd.'s, fiftieth anniversary was marked by the presentation to long-service employees, by Mr. John Waddell, chairman, of gold watches. In addition, over 1,000 travelling watches were distributed at Christmas to all of the company's employees who had served through the whole of 1952 or longer.

PLASTICS MOULDING PRODUCTIVITY REPORT.—The first of a series of public meetings to discuss the report compiled by the team which visited the U.S.A. early in 1952 will be held at the offices of the British Plastics Federation, 47-48 Piccadilly, London, W.1, at 2.30 p.m. on March 4. The meeting is not confined to members of the Federation and it will be appreciated if those who wish to attend the meeting will notify the British Plastics Federation well in advance. The report itself will be published on Monday, February 16.

"TERYLENE" FILM.—Imperial Chemical Industries, Ltd., have issued a correction to the Press release dealing with "Terylene" film ("Plastics," January, 1953, page 17). The correction, which concerns the water permeability of the film, is as follows:

The 4th property should read: Water permeability 38 degrees C. 90 per cent. R.H. g/sq.m/day/.001 in. 30

THE PLASTICS INSTITUTE.—Some 250 members, wives and friends attended the annual dance of the London Section of the Plastics Institute at the Criterion Restaurant on January 9. During the course of his short speech, Dr. Redfarn, the London Section Chairman, welcomed the distinguished visitors and other guests. Each lady received a handsome set of table mats and in addition many prizes were awarded throughout the course of a very enjoyable evening. Mr. Peter Brown deserved congratulations on both the organization of the dance and his admirable work as Master of Ceremonies.

FOURTH GAUGE AND TOOL EXHIBITION.—The fourth Gauge and Tool Exhibition to be organized by the Gauges and Tool Makers' Association of London, W.1, will be held in the New Hall, Elverton Street, Westminster, London, S.W.1, from Monday, May 17, to Friday, May 28, 1954, inclusive. The products on display will include gauges and measuring equipment; jigs, fixtures, and special tools; special-purpose machines; press tools; engineers' small tools; testing machines; moulds and dies; and diamond tools.

BAKELITE LTD., announce the resignation of Mr. K. G. Butcher, formerly Purchasing Manager. Mr. Butcher has become a director of Duncan C. Andrews, Ltd., the well-known Swedish wood-pulp importers. Mr. L. E. Whitmore has been appointed a director of Bakelite Ltd.

ERINOID, LTD.—The directors report that as a result of a reduction in casein stocks, and improvements in two departments, the dividend has been declared on the 4½ per cent. cumulative preference stock for the 12 months ending January 31, 1953.

DR. H. K. WHALLEY has resigned his post as the Development and Contracts Manager of Petrocarbon, Ltd., and Director of Refinery Equipment and Speciality Co., Ltd., and has joined British Industrial Solvents, Ltd.

PRESENTATION OF AWARDS.—At a joint meeting of the Midlands Section of the Plastics Institute and the Copolymer Society of the Birmingham College of Technology, held in Birmingham on Friday, December 19, 1952, awards were presented by the President of the Institute Mr. T. L. Birrell.

Fellowship of the Plastics Institute: S. A. Goode.

Associateships of the Plastics Institute: A. N. P. Bowe; W. V. Evans, M.Sc., F.R.I.C.

Diplomas of the Plastics Institute: E. Adams, D. G. Barnett, M. J. Beesley, J. H. Brooks, R. W. Evans, D. Grimes, R. P. Hughes, A. C. Hutchings, D. W. S. Parsons, P. J. Weetman, S. D. Westwood.

City and Guilds Final Certificates: Class I A. G. Bennett, L. D. Hudson, A. C. Hutchings, R. Jones, W. J. Langford, P. J. Weetman. Class II: J. N. Allen, D. G. Barnett, W. J. Bennett, R. E. Bentley, R. J. Ellis, H. G. L. Hering, P. Meades, J. R. Muston, R. Startin, D. P. Sutton, E. C. Whitfield.

City and Guilds Intermediate Certificates: Class I: H. R. Glendenning, F. W. L. Hill, A. J. Lovett. Class II: M. J. Cawkhill, P. L. Collins, H. W. Morgans, J. B. Smith.

City and Guilds Silver Medals (awarded annually to best student submitting papers in the Final Examination) for 1952: A. G. Bennett.

City and Guilds Bronze Medals (awarded annually to best student submitting papers in the Intermediate Examination): For 1950, J. E. Martin; for 1951, J. N. Allen; for 1952, H. R. Glendenning.

Mr. W. F. H. Dale and student with apparatus in the plastics laboratories of the College of Technology, Birmingham.

NEW HOME FOR B.S.I.—The British Standards Institution has just announced to its 7,800 subscribing members that it will move at the end of next summer into a single, self-contained office block at 2, Park Street, Mayfair. It is well over half a century since the B.S.I. occupied its first office at No. 28, Victoria Street, London. To-day the Institution spreads over seven floors of the same building and the adjoining No. 24. It also occupies extensive accommodation at 24, Gillingham Street, a mile away, behind Victoria Station. Although the floor space at "British Standards House," as the new home is to be called, is not substantially greater than that at present occupied by the B.S.I., concentration of the staff and facilities under one roof will aid efficiency and economy; and space will also be available for all the 3,800 committee meetings which the B.S.I. convenes in the course of a year.

GLASS CONTAINER FINISHES (B.S. 1918 : 1953).—The British Standards Institution announces the publication in January of a standard covering continuous screw threads for glass containers. We understand that in no case have wider tolerances been allowed than in other similar overseas standards. Copies may be obtained from the British Standards Institution, Sales Branch, 24, Victoria Street, London, S.W.1, price 2s. 6d.

RESINS FOR RUBBER is the subject of two technical bulletins published by British Resin Products, Ltd. Designed to achieve hardness reinforcement, the resins exhibit thermo-plastic characteristics when uncured, and harden under the influence of heat in the presence of aldehyde donors. The bulletins give much useful information on the applications, physical properties and processing of these resins.

INVITATION.—The London Section of the Plastics Institute has asked us to announce that visitors to London are cordially invited to the London Section's technical meetings. They hope particularly that visitors from abroad attending the B.I.F. and other exhibitions will accept this offer. They would also welcome contributions or talks from any guests.

THE PLASTICS INDUSTRY EDUCATION FUND.—At a meeting held on December 30, 1952, of the Trustees of the Fund, under the chairmanship of Mr. P. C. Allen, a scheme put forward by the Borough Polytechnic London was discussed, under the terms of which a new type of course would be inaugurated providing two years full time study. Based on the syllabus of the City and Guilds of London Institute, the course would be primarily for young men leaving grammar schools at about 16 years of age, after having taken the General Certificate of Education at the ordinary level.

The Education Committee of the Plastics Institute had unanimously supported the proposal put forward by an Advisory Committee set up by the governors of the Borough Polytechnic which had recommended that a minimum of eight students would be necessary for the success of the course and that the Trustees of the Plastics Industry Education Fund should be requested to make grants towards the maintenance of students.

The Trustees accepted the desirability of such a full time course and allotted £2,000 over a period of two years for maintenance grants to students attending the course.

At the same meeting the Trustees approved grants totalling £1,250 to technical colleges to purchase equipment. The pupil apprenticeship scheme for the plastics industry was also discussed and hope was expressed that the project would be revived.

FORTHCOMING MEETINGS

Feb. 18.—"Silicones," Dr. J. S. Flanders, B.Sc., Ph.D. The Plastics Institute, Scottish Section, North British Station Hotel, Glasgow, 7.30 p.m.

Feb. 18.—"Melamine and Melamine Resins," Dr. R. F. Goldstein, B.Sc., Ph.D., F.R.I.C., F.Inst.P. Plastics Institute, Southern Section. Polygon Hotel, Southampton, 7.30 p.m.

Feb. 20.—"The Standardization of Inserts for Moulding," A. A. Tomkins, Plastics Institute, Midlands Section. James Watt Memorial Institute, Great Charles Street, Birmingham, 3, 6.30 p.m.

Feb. 24.—"Synthetic Resin Cements used in Chemical Engineering Practice," S. K. Earp, A. E. Wiggs, S. Shapiro. Society of Chemical Industry, Plastics and Polymer Group and Chemical Engineering Group, Burlington House, Piccadilly, London, W.1, 6.30 p.m.

Feb. 25.—"What the Customer Expects of Plastics," E. Atchelor, Plastics Institute, North-Eastern Section, Newcastle.

Feb. 25.—"Constructing a Factory on an Open Site," T. W. M. Pond, B.Sc., Plastics Institute, Western Section, The Technical College, Gloucester, 7.15 p.m.

Feb. 27.—"Some Aspects of Ethenoid Plastics," Dr. R. G. Heyes, Ph.D., B.Sc., A.R.I.C. The Plastics Institute, North-Western Section, Engineers' Club, Albert Square, Manchester.

Mar. 2.—Symposium: "Production and Utilization of Petroleum Raw Materials in the U.K. Chemical Industry" (12 papers). Society of Chemical Industry, London Section, joint meeting with Institute of Petroleum. Institution of Electrical Engineers, Savoy Place, London, W.C.2, 10 a.m.

Mar. 9.—"Recent Developments in Injection Moulding"; Symposium: Machinery, K. Baigent; Moulding, J. S. Walker; Materials, J. H. Collins. Plastics Institute, London Section. The Waldorf Hotel, Aldwych, London, W.C.2, 6.30 p.m.

Mar. 10.—"De-polymerization," Professor F. S. Dainton. Society of Chemical Industry, Plastics and Polymer Group, Burlington House, Piccadilly, London, W.1, 6.30 p.m.

Mar. 11.—"Where Plastics and Rubber Meet," Maldwyn Jones, B.Sc., F.I.R.I. Plastics Institute, South Wales and Monmouthshire Section, Newport Technical College, 7 p.m.

Mar. 11.—Cameo Meeting. Plastics Institute, Yorkshire Section. Short papers given by section members. St. Mark's House, 186, Woodhouse Lane, Leeds, 2.

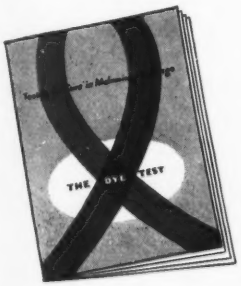
Beetle Melamine Material opens up New Markets...

SUPPLY POSITION NOW ASSURED

In canteens, cafes, cafeterias and in the home there exists a substantial market for moulded tableware. In the U.S.A. this amounts to multi-million dollar business, but in this country moulders have been unable until now to do more than touch the fringe of it because of lack of suitable material—Beetle melamine moulding powder. With the supply position assured, B.I.P. now offers this quality moulding powder to help you capture this and other valuable new markets.

Melamine is not just another aminoplastic material. Correctly cured Melamine mouldings possess considerable beauty, as well as high technical efficiency under conditions of service — but only if the three related matters of product design, mould design and controlled moulding conditions have received full attention.

In all these important matters B.I.P. will assist you to their utmost. Apart from the new, positive dye test for the immediate location of faults, B.I.P. offers unrivalled Design and Technical Services to help you obtain 'top quality' for your Melamine ware.



Melamine Mouldings—
A New Test for Cure

To enable the moulder to locate immediately moulding faults such as undercure or other contributory factors, a simple dye staining test has been evolved.

Undercured mouldings though they may be satisfactory in external appearance invariably show defects in use, such as inferior resistance to staining by hot tea and coffee or to chemical attack by hot soap solutions. The dye test can be used to determine the conditions under which mouldings without these defects are obtained. This new test, therefore, is of the utmost importance to Companies moulding Melamine tableware. The procedure is fully explained in a new B.I.P. publication, *The Dye Test*, which we shall be pleased to supply on request.

Moulded Cups *The external appearance of a moulded cup provides no indication of the condition of cure. These illustrations show two cups of identical appearance as moulded; and the same cups after subjection to the dye test. (A.1) shows a cup cured for 4 minutes; and (B.1) a similar cup cured for 5 minutes. The test clearly indicates that 4 minutes was insufficient (A.2) whilst 5 minutes produced a properly cured cup practically free from stain (B.2).*

A.1

B.1

A.2

B.2

BRITISH INDUSTRIAL PLASTICS LTD. 1 ARGYLL STREET, LONDON, W.1

The advantages of being TWO-FACED . . . . .

NESTORITE	Grade A.415
HEAT AND WATER RESISTING	
Filler	Asbestos
Particle Size (inches)	1/10
Specific Gravity	1·90
Bulk Factor	2·4–2·9
Powder Density	·65–·75
Time of Cure of Test Cup (secs.)	40–60
Recommended Flow Range	5–12
Shrinkage (thou/inch)	2·5–3·5
Flowability (cm.)	5–6
Impact Strength (ft./lb.)	·10–·15
Tensile Strength (lb./sq.in.)	4,500–5,500
Water Absorption (7 days) (mg.)	50–70
Plastic Yield Grading (°C.)	180
Blister Temperature (50°C. per hr. rise)	200–210
Shrinkage after heating 5" disc for 24 hrs. at 140°C. (thou/in.)	1·2
Heat Resistance (½ hr. at 400°C.) (lb.)	500
Electric Strength at 90°C. minute value (V/mil.)	40–100
Surface Resistivity after immersion (log₁₀ohms)	10·5–12·0
Volume Resistivity (as moulded) (log₁₀ohm cm.)	11·0–12·5
Power Factor at 10^6c/s.	·03–·04
Permitivity at 10^6c/s.	5·20–5·70

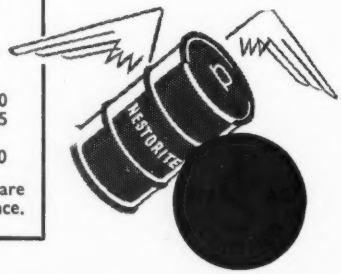
A fast-curing material but difficult to mould. Mouldings are mechanically weak but have good heat and water resistance.

Janus, the keeper of the door between the years (and to whom January owes its name) was able, through possessing two heads, to look back into the past and forward to the future.

This ability to look backwards and forwards at the same time is possessed—when crossing streets in busy traffic—by those mortals born under his influence.

Tradition states that Janus was also a Weather Controller, and thus it may be assumed that he had a waterproof face to withstand the cold torrential rains of an English Summer, and a heatproof face that survived the heat of a Southern Winter.

So there are advantages in being "two-faced"—*particularly* in Mouldings that must have sufficient "intestinal fortitude" to be PROOF against water and/or heat. The "Nestorite" prescription is appended.



YOU'RE RIGHT WITH 'NESTORITE'

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LEA PARK WORKS, PRINCE GEORGE'S RD., MERTON ABBEY, LONDON S.W.19.

Telephone MITCHAM 2283 (5 LINES) *Telegrams* NESTORIUS SOUPHONE LONDON

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134, Avenue de Villiers, Paris 17, France.

JOSE DELCLOS,
Angel Baixeras, 39, Barcelona (2), Spain.

EINAR HOLMARK, 19, Gl. Kongevej,
Copenhagen V, Denmark.

EKCO ACCOUNTANT HONOURED.—Appointed a member of the Order of the British Empire in the New Year Honours List is Mr. Douglas Jones, Cost Accountant of E. K. Cole, Ltd. Mr. Jones joined Ekco in 1927 and headed the Government Contracts Liaison Department of the company during the war.

DAVID BRIDGE AND CO., LTD.—The appointment of Mr. Joseph Brown as chairman and managing director has been announced. Mr. Brown has been with the company for over 30 years and the previous appointments he has held include the positions of chief engineer, technical director and joint managing director.

LACRINOID PRODUCTS, LTD., announce an arrangement with Kautex-Werk Reinold Hagen, Hangelar üb. Siegburg, Germany, to cover the entire manufacturing programme, including the use of Kautex-Werk processes. Lacrinoid Products, Ltd., are now the sole licensees for the Commonwealth countries for all Kautex-Werk patents and secret processes, including the blowing of hollow articles from both polythene and p.v.c., and the manufacture of Vietum covers and sleeving, for the covering by shrinkage of rods, bars and tubes in a great variety of profiles. There is no connection between the German firm and British Kautex, Ltd.

O. AND M. KLEEMAN, LTD.—In the report of the directors published on January 6, 1953, covering the year ended August 31, 1952, a cut in the final dividend was announced of 10 per cent. The payment of a final dividend of 25 per cent. reflects the general recession in trade, which in the words of the chairman, "has affected the plastics industry with special severity." Mr. D. Kleeman has, however, been able to report favourably on the developments of the subsidiary companies. Current assets amount to £604,927, the trading profit for 1952 being £168,147 as against £286,217 for 1951.

TELCON CABLES.—A new publication issued by the Telegraph Construction and Maintenance Co., Ltd., describes cables for telecommunication purposes. The publication contains a wealth of figures and is well illustrated.

WILLIAMS (HOUNSLOW), LTD.—We have received a handsomely bound and printed booklet entitled "Seventy-five Years of Progress," which traces the history of Williams (Hounslow), Ltd., from Charles Greville Williams who, in 1857, discovered the first quinoline dyestuff Cyanine, to the modern plant which to-day produces colours for foodstuffs, paints, printing inks, leather and a host of other industries.

WICKMAN, LTD., announce that their interests in industrial high frequency heating equipment previously operated as a separate subsidiary business under the name of Applied High Frequency, Ltd., will, from January 5, 1953, be run directly as a Division of the company under the title of Wickman, Ltd., Applied High Frequency Division. The address of the new Division will be the same as that of Applied High Frequency, Ltd., namely, Actarc Works, Goldhawk Road, London, W.12.

Mr. W. E. S. TOOMEY announces that having relinquished his position with Cannon (Holdings), Ltd., he has joined the staff of Howard Pneumatic Engineering Co., Ltd., Fort Road, Eastbourne, Sussex, manufacturers of rotary, proportioning, and special pumps.

ERRATUM.—Page 24 of the January issue, 1953, made reference to the new Duplex Mixer. It is regretted that the name of the manufacturer of this machine was omitted, the manufacturer being the Morton Machine Company, Atlantic Works, Wishaw, Scotland.

British Plastics Convention, 1953

We have received details of the papers to be read at the Convention which opens on Monday, June 8, 1953, at Olympia, London.

Monday, June 8, 4 p.m.

Inaugural address: The Right Hon. the Earl of Halsbury, F.R.I.C., F.Inst.P. (Managing Director, the National Research Development Corporation).

Tuesday, June 9, 10.15 a.m.

Unplasticized p.v.c. Problems related to the manipulation of unplasticized p.v.c., by J. J. P. Staudinger, Dr. Ing. (Director, British Resin Products, Ltd.). Industrial application of unplasticized p.v.c., by J. G. Byers (Technical Service and Development Department, Imperial Chemical Industries, Ltd., Plastics Division).

Tuesday, June 9, 2.30 p.m.

Plastics Material Developments. Recent commercial developments in melamine and guanamine resins, by F. J. Mills, M.Sc., Ph.D. (Technical Service and Plastics Evaluations Sections, British Oxygen Co., Ltd.). Moulded and extruded polyamides and polyesters, by W. C. Fergusson, B.Sc., Ph.D. (Technical Service and Development Department, Imperial Chemical Industries, Ltd., Plastics Division). Silicones in the plastics industry, by J. H. E. Jeffes, B.Sc., (Manager Technical Service Department, Midland Silicones, Ltd.).

Wednesday, June 10, 10.15 a.m.

Reinforced Plastics—1. Surface chemistry and adhesion of glass and plastics, by H. Cole, M.A., F.R.I.C., F.S.G.T. (Research Department, Pilkington Brothers, Ltd.). Plastics containing asbestos as a reinforcing filler, by J. E. Gordon, B.Sc. (Royal Aircraft Establishment, Farnborough). A critical survey of commercial contact resins, by V. E. Yarsley, D.Sc., M.Sc., F.R.I.C., F.P.I., and A. G. Goodchild, B.Sc., A.R.I.C.

Wednesday, June 10, 2.30 p.m.

Reinforced Plastics—2. Some considerations in the design and manufacture of structures in glass-reinforced plastics, by G. C. Hulbert, B.Sc. (Development Engineers' Department, Bristol Aeroplane Co., Ltd., Aircraft Division). Some problems associated with the design and manufacture of asbestos-reinforced plastics, by D. S. Bancroft, A.F.R.Ae.S. (Assistant Chief Designer, F. G. Miles, Ltd.).

Thursday, June 11, 10.15 a.m.

Durability and Performance—1. The durability of plastics under Post Office conditions, by A. D. W. Downes, B.Sc., F.R.I.C., and A. A. New, M.Sc., F.R.I.C. (Research Branch, Post Office Engineering Department).

Thursday, June 11, 2.30 p.m.

Durability and Performance—2. The durability of adhesives for wood, by R. A. G. Knight, B.Sc.(Eng.), M.I.Mech.E. (Officer-in-Charge, Composite Wood Section, Forest Products Research Laboratory).

Friday, June 12, 10.15 a.m.

Selling to the Public. Merchandizing p.v.c. film and related products, by R. L. M. Baxter (Sales Manager, The Greenwich Leathercloth Co., Ltd.). Marketing melamine tableware, by H. A. Brooks (British Industrial Plastics, Ltd.). Plastics in the toy industry, by W. Graeme Lines (Sales Director, Lines Brothers, Ltd.). Design in plastics—who is to blame? by Paul Reilly (Council of Industrial Design).

Monday, June 15, 2.30 p.m.

Moulding—1. A study of the problems involved in high-quality injection moulding, by E. Gaspar, Dipl.-Ing. E.T.H. Zurich, A.M.I.Mech.E. (Chief Designer, The Projectile and Engineering Co., Ltd.).

Tuesday, June 16, 10.15 a.m.

Moulding—2. The economics of large moulding machines, by D. Radford (Executive Director and General Manager, E. K. Cole, Ltd.).

Wednesday, June 17, 2.30 p.m.

New uses in industry—1. Plastics in the telecommunications field, by R. C. Mildner, M.Sc., M.I.E.E., and H. F. Wilson, B.Sc., A.R.I.C., A.I.R.I., F.R.S.A., and E. I. Cooke, M.A., B.Sc. (Telegraph Construction and Maintenance Co., Ltd.). (The paper will be read by Mr. Mildner.) The metallization of plastics by vacuum evaporation for functional and scientific purposes, by L. Holland (Research Laboratory, W. Edwards and Co. (London), Ltd.).

New uses in industry—2. Plastics in the footwear industry, by W. E. Booth, B.Sc. (Physics Department, The British Boot, Shoe and Allied Trades Research Association). Flameproof conveyor belting, by S. J. Skinner, Ph.D., B.Sc., A.I.R.I. (Sales Manager, British Geon, Ltd.).

Factors Affecting the High-speed Tapping of Plastics

By W. M. HALLIDAY

Threading holes in plastics is often troublesome and difficult. Objections often occur not because of serious inadequacies of tapping tools, but from neglect of other operating factors. Some of these latter, and useful safeguarding precautions, are here described ; interesting results are also given of certain practical tests to ascertain comparative cutting merits and durability of various kinds of taps.

AN ever-increasing number and variety of plastics materials are now finding regular application and use in engineering, as substitutes for metals, or non-metallic substances such as natural rubber, glass, wood, ceramics, cork, etc., because of their superior properties. In the main, plastics are comparatively easy and inexpensive to machine by any of the conventional engineering cutting processes normally employable in forming metals.

Most machinists, however, consider that plastics, chiefly the synthetic thermo-setting resins and the thermoplastics are extremely difficult to tap.

Undoubtedly many troubles are encountered with these materials, especially when threading holes of small diameter, of blind depth and in fine pitch, where the length of hole is more than about twice the diameter. If holes of this kind have to be tapped to precision tolerance on thread sizes and surface finish, and at high speed, frequently very considerable difficulties may be presented to the machinist.

Nature of troubles experienced

The tapping of plastics materials is usually associated with much risk of stripping threads in the hole; rapid blunting of cutting edges on the tap; short working life of such tool, and a high rate of tap breakage. Moreover, the speed of such tapping operations and scale of output will generally be considerably below that possible when tapping ordinary engineering metals. Poor surface finish of threads, and loss of precision on sizes are also other troublesome features occurring with this operation.

Limitations of Inserts

One of the most satisfactory means to avoid such troubles in machining threaded holes is to employ a metallic sleeve insert having the bore tapped before introducing it into a plastic mould. Such insert will then be moulded " in situ " within the walls of the plastics article.

This solution, however, is limited since it will only be possible with moulded type components. It will only then be feasible providing the configuration, features and general design of the part permits such inserts to be readily and economically fitted in the mould. Generally the factors of location, retention and feeding inserts to the mould cavities will be the chief determining considerations.

Use of inserts, despite their possible simplifications of later tapping or machining requirements, will, of course, be out of the question in the case of innumerable articles fabricated, wholly or in parts, from other non-moulded forms of plastics materials, i.e., sheets, rods, etc., as produced by casting, extruding and pressing methods.

Features of Tapping Plastics

In tapping any moulded, cast or pressed synthetic resin plastics it will be found that a certain amount of contraction occurs in the size of the hole by the cutting action of the tap. Upon reversal of the tool after threading to the required depth, such shrinkage may give undesirable binding of the tool. Such binding action will often be very considerable, sufficient in fact to cause the tap to become powerfully jammed in the hole; or to cause it to strip some or even all the threads; or to mar seriously the surface finish or accuracy of threads; or even, in extreme cases, to fracture the tap. These latter risks will be most prevalent where the hole is of very small diameter and long length, in tapping which the tool will have a relatively large surface in contact with the threaded hole.

The shank of the tap will be of comparatively slender proportions and thus may prove incapable of withstanding the greatly additional loading caused by such frictional resistance, and rubbing occurring during extraction of the tool.

With machine tapping a greater driving pressure may be required to overcome such binding forces, and often, because of the insensitivity of such machine operation, the tool may be more easily overloaded and fractured.

Upon withdrawing a tap from a threaded hole, in a plastics material, the same rubbing action will entail a degree of lapping of the critical cutting edges of the tap. Most plastics materials produce quantities of chips which are highly abrasive, and in tapping some proportion of the chips will adhere to the tap flutes during operation. Such lapping action may result in speedy and extensive wear on the tap, this generally being concentrated on cutting edges, crests, flanks and roots of threads.

Thus serious errors and damage may be reproduced in a threaded hole; resulting lack of conformity to the correct thread form and pitch may prevent the proper engagement of the screw component to be used in conjunction with the hole.

The contraction of plastics material around a hole being threaded will largely originate from the highly-localized heating of that portion of the article by the downward (cutting) progress of the tap. Therefore, it will be appreciated, if the cutting edges of the tap are allowed to become dull or worn, threading will be accompanied by an ever-increasing amount of heating, and thus a greater degree of shrinkage will occur. Rubbing and binding tendencies will likewise be accelerated leading to some or all of the previously-mentioned troubles being encountered.

Some useful practical tapping tests

To overcome such operating difficulties, when having to tap large quantities of compression-moulded components, in the thermo-setting plastic " Bakelite," a number of tests were conducted to determine the following points, which were in some doubt by the engineer having to undertake the machining.

(1) The most suitable tap materials and forms to be employed, and the comparative working efficiency and durability of different types of taps, etc. (2) The most suitable working conditions, i.e., the speed and feed for tap; the best kind of lubricant, means for reducing heat, improving finish and accuracy, and the protection of tools. (3) How the keenest cutting action of the tap could be maintained. (4) Generally to ascertain how tapping operations could be performed to ensure most rapid and economical machining.

The results obtained from such tests will doubtless prove of interest and guidance, especially for the engineer working in such new materials, and who may be experiencing some or all of the above-mentioned objections because of unwitting adherence to orthodox methods of tapping as applicable to metals.

Kind of tap

Whilst it is known that the quality of steel from which a tap is made is of the utmost importance in determining its durability, cutting capacity, and resharpening requirements, etc., little useful data appeared available in reference to tapping plastics, to enable a reliable assessment to be reached of the relative economy of various tap materials used for such purposes.

For instance, it was not clearly evident what scale of tapping performance could be expected from ordinary carbon-steel cut-thread taps of standard pattern, or how such service compared with that obtainable from high-speed steel cut and ground thread taps. On the other hand, the engineer found there was a dearth of reliable information upon the relative merits of standard and special tap forms, particularly as to the effects of non-standard lead angles; hooking of cutting edges to give either positive or negative rake; the provision and influence of clearance lands behind cutting edges, and the best size of drilled hole in plastics material calculated to impose the minimum loading, rubbing and wear on taps.

To derive practical answers to some of these important questions a series of comparative tests was made with sets of taps in each of the above-mentioned materials, and to standard and non-standard forms.

In every test case taps were of the same diameter, and pitch of threads. The same plastics material was employed with them all, and the methods of procedure and results are shown in the table on the opposite page.

Table of Tapping Tests

Type of Tool	Procedure and Results	Conclusions
Carbon steel taps, unground threads. *Unsharpened.*	430 holes threaded before final degradation; running speed of no consequence below 38 ft. per minute. Above 48 ft. number of holes reduced to 370. Checks made over 50 holes. At speed of 40 ft. per minute wear had taken place at 200 holes, causing considerable chipping and plastic thread breakage. At 300 holes binding and frictional drag occurred on all taps. For each further 50 holes tapped beyond 300 wear increased in a rapid manner; taps discarded at 450 holes. Pressure required to turn tap necessitated 20 per cent. increase after threading of 125 holes. After next 100 holes pressure increased to about 33 per cent., rising to 61 per cent. when 400 holes had been tapped.	It was found that taps made from plain carbon steel had an extremely limited working life; production of satisfactory threads was low. Serious objections were encountered in respect of surface finish and quality of threads after 250 holes. Coincident upon this was the increase in pressure required which caused considerable frictional drag. Heat build-up probably shortened the tap life.
Sharpened.	Cutting edges restored solely by very light grinding along the edges abutting into the tap flutes. To maintain good quality threads, resharpening was necessary after tapping some 120 holes; further resharpening required after each 60-70 holes machined. Resharpening permitted some 530 holes to be tapped, of which 92 per cent. could be graded as satisfactory. This compares favourably with the unsharpened tests where only about 250 holes were satisfactory for service use. Sharpened taps produced holes of greater accuracy and better surface, minimized heating and excessive binding, and substantially reduced the pressure required to turn the tap.	Both unsharpened and sharpened carbon steel taps with unground threads showed that production was limited to some 450 holes; with this kind of tool resharpening was very desirable. The failure of the resharpened taps at 450 holes could be contributed to some drawing of tap temper during each resharpening operation.
High-speed steel taps with cut threads. *Unsharpened.*	730 holes threaded before final degradation. Running speed of no consequence provided it was kept below 62 ft. per minute. Higher speeds drastically reduced holes tapped and led to very rapid deterioration of quality of finished threads. Periodic checks showed that after 350 holes wear was noticeable on cutting edges. After 450 holes thread wear was sufficient to give rise to surface finish faults. From 500 holes onwards binding and rubbing troubles were encountered, together with increased heat generation. On average, driving pressure was 10-20 per cent. less than with the carbon steel taps.	From about 600 holes pressure had to be increased to maintain the tap in cut, but the pressure required was still substantially lower than was necessary for carbon steel taps nearing the end of their working life. Wear was particularly noticeable after 600 holes on the first two or three threads of each tap.
Sharpened.	Total number of holes increased by 30-40 per cent., i.e., 970-980. Resharpening required after every 100 holes tapped. A substantial reduction in driving pressure was effected by regular resharpening to maintain keen cutting conditions.	Generally, regular resharpening of these tools (by lapping sides of flutes only) produced a much more beneficial effect than the same procedure adopted with carbon steel taps.
High-speed steel taps with ground threads. *Unsharpened.*	On average 900 to 940 holes threaded before these taps became worn beyond the economic recovery point. After some 650 holes the surface finish in the tapped threads began to show faint signs of faults by chipping and tearing. After 750 holes blunting of cutting edges was extensive, causing increased rubbing and considerable heat. Driving pressure was on average 10 per cent. less than with high-speed steel taps with cut threads up to 750-780 holes. Beyond this point the pressure required was virtually the same.	After approximately 750 holes the quality of threads in work was poor, with slight yet distinct indications of chipping and roughness from which it could be assumed that the reasonable working life of unsharpened tools of this kind is not greater than 800 holes.
Sharpened.	Resharpening after approximately every 150 holes increased tap life and number of threaded holes by 45 per cent.	Again resharpening was responsible for extending tap life and thus increasing productivity of the tap. In addition, resharpening substantially improved quality of finished threads and reduced the driving pressure necessary.
High-speed steel ground thread, chromium-plated taps. *Unsharpened.*	1,500 holes threaded before tool required resharpening. After 1,200 holes surface finish of threads became ragged with tendency to chip. Between 1,200 and 1,500 holes heat build-up was considerable. Pressure required was 7 per cent. less than the non-plated high-speed steel taps having ground threads.	Whilst it was possible to produce up to 1,500 holes, and although resharpening could sometimes be effected at this point, nevertheless it was frequently found that the only method of employing the tool further was to cut off the worn portion and resharpen the remaining stub.
Sharpened.	Resharpening was effected by lightly rubbing a fine grit oil stone along the sides of the flutes. Three or four such stonings could be made before penetrating the chromium plate. By this method up to 1,800 holes could be tapped without serious difficulty. By limiting holes tapped to only 1,200 instead of the maximum number possible of 1,500, resharpening could be coupled with replating. It was found to be feasible to replate taps 9 or 10 times provided that great care was taken not to allow the cutting edges to become severely worn from true shape.	By careful treatment of these tools, and by coupling resharpening and replating, taps could be expected to yield some 6,000 holes, representing a vastly superior performance over all the other taps subjected to the same test. Despite the higher initial price of chromium-plated tools the use of these taps would in practice seem to be an economic proposition.

Tap forms

In all the comparative tests, taps having ordinary standard thread forms and rake angles on cutting edges were used.

In order to increase cutting capacity, and to reduce binding and heat generation variations were employed as follows:

(1) A tap having a five-degree positive hook angle on the cutting edge gave cleaner cutting and reduced heat generation. However, the total number of holes produced was slightly lower than with standard ground taps.

(2) A tap having a negative rake of four-degrees on the front side of the land reduced the heat generated but very great care had to be taken in regulating the number of holes tapped in between regrinds to ensure the minimum amount of wear on cutting edges.

It was found that the landed surfaces had to be very smoothly polished, devoid of the slightest step, and not carried too close to the cutting edge.

Other tap features

A tap removed from service at the correct time should appear in good condition, particularly high-speed steel-plated and un-plated tools having ground threads. However, if the cutting edges are examined under a magnifying glass, a very slight amount of rounding will indicate the necessity for resharpening.

The taps used in the foregoing tests were three-fluted, but to ascertain if any advantage were to be gained by the use of two- or four-flute taps a test of this feature was also made. Results showed that the three-flute taps offered greater facilities for the escape of chips during cutting, and coolant could be applied to critical cutting edges more easily.

On the other hand, with the four-flute taps, the lands of threads were slightly narrower, thus leading to lessened friction and liability to bind during removal.

Two-fluted taps, or " gun " taps, because of their broad lands back of cutting edges were certainly found most unsuitable for tapping plastics materials. Very high heat was engendered by such taps causing the tapped hole to shrink with greater severity and rapidity onto the wide lands, resulting in great binding of tap, and acute wear on those land surfaces.

Tap speeds

It was clearly revealed by these tests that tap speed was an important factor in controlling the amount of heat generated during cutting and retraction, and in limiting binding, rubbing and wearing tendencies.

High-speed steel taps, either with ground or chromium-plated threads, gave best service performance, and it was found the most suitable speed to operate such tools was 42 to 54 ft. per minute. Much lower speeds were inimical to clean sweet cutting, whilst appreciably greater speeds led to troubles by serious over-heating, excessive shrinkage of material, frequent seizure of tool, and rapid blunting of cutting edges.

Mounting the Workpiece

Another useful feature emerging from the above-mentioned tests was the desirability of using as little pressure as possible when starting tap into the hole in the work. The tap should in fact be free to take its own lead into the work. If it cannot do this the first two or three threads of the hole may be stripped completely off when the tap is forcibly engaged.

To avoid this trouble, it was found to be advantageous to arrange for the tap, or fixture in which plastics component is mounted, to have slight amount of axial floating movement equivalent to about three pitches of the tap threads.

When tapping very small diameter holes, or fine pitches, it will be very important to employ a sensitive type of tapping machine. The rotating driving disc, spindle and other units should possess the smallest amount of inertia. This will prevent over-running and excessive loading of the tap, and will enable the operator to " feel " when added resistance is presented to the progress of the tap. Thus blunting of cutting edges, over-heating effects, jamming of chips in hole or tap flutes, rough cutting, etc., will be more easily detected.

The feed of the tap should also be uniform, steady and continuously maintained.

Precautions should be taken to avoid any movement of the work-piece, particularly lateral; particularly with sheets, slight bending due to pressure applied to the tap can result in binding and subsequent fracture of the tap shank.

Coolants and Lubricants

Certain plastics materials can be tapped dry, but the use of lubricants and coolants can effectively reduce heat generation. Lubricants should have free flowing properties; mineral or sulphur base lubricants normally employed for the tapping of metals and alloys are not very suitable for use with plastics materials.

A fine stream of water at a pressure of 5 to 10 lb. p.s.i., directed into the mouth of the hole being tapped in a sharply downward direction will flush out swarf and cool the tool.

Compressed air, at a pressure not exceeding 5 lbs. p.s.i., can be directed onto the tap or mouth of hole. A disadvantage is the increase of airborne dust with commensurate fire and operational hazards.

Size of Tapped Hole

To a considerable degree the successful tapping of plastics materials will be determined by the size of the hole and the actual amount of stock to be removed by the tap.

The greatest objections will obviously be encountered where a full or near 100 per cent. depth of thread is to be obtained. In practice this will rarely be necessary, and for most general fastening purposes a thread depth of between 75-80 per cent. total possible value will prove amply sufficient.

By the control of thread depth to this latter value it will be possible to obtain smoother cutting action; less loading and over-heating of tap, and longer working life for such tool in between regrinds. Moreover, the quality of tapped threads will be considerably improved. With threads formed to the full possible depth, the crests will approach to almost a sharp edge, which will be easily liable to fracture, especially when the tap is being withdrawn.

By reducing thread depth from use of a slightly larger drilled or cored hole in the plastics component, the crests of threads will be flattened. This will not only serve to increase the general strength of threads, but will minimize the tendency towards chipping and breakage at the crests during actual tapping, or when the screw is threaded into place during later assembly operations.

In the case of holes which are to be hand tapped a greater thread depth may be employed without undue disadvantage because greater sensitivity will enable the operator to detect tap binding.

Where the hole has been drilled, care should be taken to ensure the smoothest finish on the sides thereof. Torn, stepped or excessively rough hole surfaces will increase the loading on taps, and lead to additional heat being generated.

Blind holes should be drilled an ample depth to provide the required length of full-size threads, and adequate run-out for the undersize leading edges of the tap. Wherever possible it will be advisable to employ full-through holes in preference to blind ones, because accumulation of chips and clogging tendency will be more easily eliminated.

Conclusion

Whilst the simple practical tests just outlined are not claimed to be exhaustive of all the tapping problems encountered with plastics materials of every kind, the results indicate that chromium-plated ground thread high-speed steel taps may be relied upon to give the best service performance, both in respect of economical working life of tools, and finish of threaded holes.

The tests also show that no special or unusual thread forms need be employed on taps for most general purposes. Tap overloading and greater tendency towards pick up particularly with non-plated cut thread taps will often be traceable to the use of an inferior quality or dirty lubricant. To avoid contamination, by dirt, metallic chips, etc., coolants and lubricants should not be stored in open containers and every effort should be made to ensure that they are, when used, entirely free from contamination.

" The Motor's " Golden Jubilee

On January 28 our associated weekly journal, " The Motor," completed 50 years of publication and marked the occasion by the production of a special Golden Jubilee Number.

First published under its present title on January 28, 1903, " The Motor " grew out of an earlier Temple Press weekly journal, " Motor Cycling and Motoring," and motor-cycling as well as motoring continued to be dealt with by " The Motor " until 1909, when the rapidly developing world of motoring absorbed its full attention and " Motor Cycling " resumed publication as a separate journal.

The history of " The Motor " is very much that of the motoring movement with which the journal has grown up since the earliest days and a feature of its Golden Jubilee Issue was a special supplement recalling motoring " high lights " of the past 50 years and illustrated by many photographs of historical interest, including some never previously published.

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2s. 8d. each (including postage).

B.P. 676,685. Methods of and means for jointing or uniting synthetic materials. To: Co. Générale d'Electricité (France).

Damaged parts of electric cables are reconstituted by hot-spraying a layer of polymers of ethylene or polyvinyl chlorides, derivatives of styrene or polyamides or other such materials on to the damaged spot.

B.P. 676,718. Process for producing protective layers on metallic surfaces. E. Vilaseca.

Successive layers of synthetic resin with high proportion of macro-molecules of linear structure in the layer on the metallic surface, decreasing in succeeding layers, with the reverse properties with regard to macromolecules of a three-dimensional structure, which progressively increase, are subjected to an intermediate separate, then to a final complete heat treatment.

B.P. 676,723. Copolymers of a diene hydrocarbon and unsaturated fluorinated compounds. To: Brit. Thomson-Houston Co. Ltd. (U.S.A.).

B.P. 676,727. Method of forming moulds for casting thermosetting transparent enclosures for example for aircraft canopies. To: Goodyear Aircraft Corporation.

Two outer sheets at least one of which is Plexiglass (or Lucite), and an inner sheet of similar material are secured together along their edges and heated and formed by blowing or centrifugal force. When the inner sheet is removed the outer sheets form male and female mould parts for casting canopies, which then are polymerized and hardened by ultraviolet light.

B.P. 676,737. High boiling esters as solvents for polychlorotrifluoroethylene. To: Brit. Thomson-Houston Co. Ltd. (U.S.A.).

B.P. 676,765. Coated article and coating composition. J. Bjorksten, S. O. Fiedler, L. L. Yaeger. To: Nash-Kelvinator Corp. (U.S.A.).

A polystyrene surface is coated with a thermoplastic-type acrylate or a mixture of such acrylate with a cellulose ester. The coating is applied in a solvent which does not dissolve polystyrene, by dipping or spraying to form an integral bond with the polystyrene.

B.P. 676,782. Snap-fasteners made from synthetic resin. F. Kriz (France).

B.P. 676,785. Polymeric materials and processes for their production. J. W. Fisher, G. B. May, E. W. Wheatley. To: Brit. Celanese, Ltd.

The new polymers are polysulphone triazoles or polysulphone aminotriazoles.

B.P. 676,869. Spectacles frames. A. A. Irons, Optical Products, Ltd.

The frame for sun glasses has grooves for the lenses to be slid into position.

B.P. 676,873. Door knobs or handles. Evered and Co., Ltd., A. H. Wilson.

B.P. 676,886. Laminated products from synthetic resins. To: Formica Co. (U.S.A.).

A paper sheet (coloured; printed) is impregnated with a phenol-formaldehyde resin, dried and then sprayed with a melamine resin containing flock (purified finely ground cellulose fibres). The component sheets are consolidated under heat and pressure.

B.P. 676,889. Polymeric materials. H. A. Bruson. To: Industrial Rayon Corp. (U.S.A.).

A mixture of acrylonitrile and a monovinyl ether of an amino-alcohol or a salt thereof is copolymerized.

B.P. 676,893. Foils for electrical equipment, in particular capacitors. To: Farbenfabriken Bayer (Germany).

The dielectric plastic layer consists of polyhydroxy compounds containing 9.5 to 15 per cent. OH-groups.

B.P. 676,987. Self-sealing insulating material of high dielectric strength. To: Bishop Mfg. Corp. (U.S.A.).

The composition consists essentially of polyethylene and contains further butyl rubber, an isobutylene polymer, a resinous tackifier (abietic acid derivative). It is formed as a tape. When wound around a conductor the stretched overlapping portions flow together into a homogeneous body.

B.P. 677,015. Handles for containers. Lacrinoid Prod., Ltd., R. J. Hooper.

B.P. 677,080. Plasticizers. To: Henkel and Cie G.m.b.H. (Germany).

A certain alkyl- or cycloalkyl benzene sulphonamide is incorporated in vinyl polymers (polyvinyl chloride; polyvinyl chloride-acetate).

B.P. 677,130. Plain bearings or the like. Glacier Metal Co., Ltd., W. H. Tait.

Tetra-fluoro-ethylene, or a polyamide resin (nylon), or a phenol formaldehyde or other synthetic compound, is the non-metallic bearing material in which particles are dispersed capable of being dissolved by the lubricant so as to produce a minutely pitted surface (e.g., powdered nylon mixed with powdered sodium carbonate, injection moulded into bearing or liner to be lubricated later with water).

B.P. 677,183. Production of moisture-proof film. W. Berry, C. R. Oswin, E. G. Sanderson. To: Brit. Cellophane, Ltd.

A certain resin-carrying base film or sheet (regenerated cellulose) is coated with a composition comprising a cellulosic base, a gum or a resin, and a wax or wax-like material.

B.P. 677,184. Production of aqueous dispersions of partially condensed hydrophilic urea - formaldehyde / alcohol resins. W. Berry, C. R. Oswin, E. G. Sanderson. To: Brit. Cellophane, Ltd.

B.P. 677,203. Complex metal - phenol - nitrogen compounds and resins containing the same. To: Union Carbide and Carbon Corp. (U.S.A.).

B.P. 677,212. Method of producing bottles and the like from plastic materials. To: Svenska Aktiebolaget Polva (Sweden).

The material is fed in semi-flowing condition through a nozzle into a mould the base of which (farthest from the nozzle) is divided in two portions. When the tube is fed into the space between these two portions they close and the bottle is blown by introducing compressed air into the tube. The mould is then removed from the nozzle, the air pressure breaking the connection between tube and bottle.

B.P. 677,231. Mould or die for the casting or moulding of spools for electrical tuning coils, coupling coils and choking coils for radio receivers. W. Hauerslev (Denmark).

To overcome the difficulties in milling narrow grooves in metallic dies or moulds for the plastics spools (from material of the polystyrol group) having grooves between small high ridges for accommodating thin and thick wires of different windings in the same groove between the ridges, the moulds are built up of thin flat rings with stepped shoulders on the inner rims of these rings. The resultant stepped grooves of the spool between these shoulders keep the two wire windings out of contact.

B.P. 677,232. Method of manufacturing pencils. C. Lovenian (Roumania).

Sheath material mouldable by heat and pressure and a marking core are fed in an extrusion device in the same direction, but at the point of contact at such an angle that higher pressure for depositing the sheath around the core, which could damage the core, is not transmitted to the core.

B.P. 677,312. Method for the production of moulded materials and articles from wood splinters and artificial resin. O. Kreibaum (Germany).

The material is compressed in successive layers so that the splinters obtain a certain orientation with thermosetting resin acting as bond. Plywood, panels, shaped articles may be produced.

B.P. 677,343. Pulley bearings. J. Walmsley, C. W. R. Winter. To: Morgan Crucible Co., Ltd.

For use in cotton spinning, bearings previously designed as a wooden bush in a thin steel pressing, are made from a self-lubricating metal sleeve in a Bakelite moulding (or an aluminium-alloy casting).

B.P. 677,350. Method of preparing halomethylated polymers of alkenyl aromatic compounds. To: Dow Chemical Co. (U.S.A.).

The polymers are useful as intermediate agents for the preparation of certain other polymer derivatives.

B.P. 677,354. Production of vinyl, 2-, 3-, 4-, 5-tetrachlorobenzoate polymers and copolymers. To: Brit. Thomson-Houston Co., Ltd. (U.S.A.).

The new materials, obtained by reacting 2-, 3-, 4-, 5-tetrachlorobenzoic acid with a certain vinyl ester in the presence of a catalyst, are suitable for moulding, laminating, casting, coating, adhesive applications.

B.P. 677,369. Plasticized vinyl halide resins and electrical conductors insulated therewith. To: Brit. Thomson-Houston Co., Ltd. (U.S.A.).

A certain class of chain-stopped linear permanently fusible liquid polyesters is extremely efficient as plasticizers for vinyl halide resins imparting outstanding flexibility at low temperature, light, weather and oil resistance. The plasticized resins may be used as insulators, but also for making shower curtains, table cloths, rain coats.

B.P. 677,394. Cable or wire plastic securing device. J. Odegaard.

B.P. 677,397. Methods of polymerization. To: Dow Chemical Co. (U.S.A.).

A non-emulsified aqueous suspension of monomeric vinylidene chloride, vinyl chloride or acrylonitrile (or mixtures) is polymerized in a closed system in the presence of a catalyst (0.2 to 1 per cent. 2-, 4-dichlorobenzoyl peroxide) and a certain low-viscosity methyl hydroxypropyl cellulose (0.1 to 5 per cent.). Moulded test specimens showed at least the same resistance to discoloration by light and heat than the corresponding emulsion polymer, which has finer particles with a tendency to agglomeration.

B.P. 677,411. Needle cases. N. T. Sanders. To: Needle Industries, Ltd.

A one-piece moulding of transparent material has an insert of cardboard or plastic dividing it into longitudinal compartments and is closed by a metal cap with an eccentric hole.

B.P. 677,429. Preparation of modified alkyd resins. L. Shechter, J. M. Whelan, Jr. To: Union Carbide and Carbon Corp. (U.S.A.).

B.P. 677,433. Modified rosin esters. L. Shechter, J. M. Whelan, Jr. To: Union Carbide and Carbon Corp. (U.S.A.).

B.P. 677,434. Lubricants for metal patterns used in a moulding process. J. Fallows. To: Polygram Casting Co.

B.P. 677,438. Manufacture of resinous products from dihydropyran derivatives. To: NV de Bataafsche Petroleum Maatschappij (U.S.A.).

The product may be utilized for adhesive and coating compositions, cast and moulded articles.

B.P. 677,505. Thermostable polymeric vinylidene chloride composition. E. C. Britton, W. J. Lefevre. To: Dow Chemical Co.

Small amounts of ethylene-diamine, N-, N'-tetra-acetic acid and its alkali metal and alkaline earth metal salts are incorporated. This incorporation (0.5 to 5 per cent.) overcomes the tendency to darken on heating.

B.P. 677,516. Production of linear polyamides. D. T. Mowry. To: Monsanto Chemical Co. (U.S.A.).

B.P. 677,570. Inflators for cycle tyres. F. W. Bluemel. To: Bluemel Bros., Ltd.

The injection-moulded (celluloid or other plastic material) barrel has increased resistance to fracture by providing ribs along its outer face.

B.P. 677,592. Container for pharmaceuticals and the like. F. E. Brown (U.S.A.).

The container body is formed of a pliable thermoplastic substance (polyethylene). The dispensing passage terminates in a pair of lips sealed by a thermoplastic resin of lower molecular weight (" Saran ") than the body substance and rupturable on pressure by squeezing the body (capsule).

B.P. 677,594. Process for polymerizing alpha-methyl styrene. To: Dow Chemical Co. (U.S.A.).

The reaction takes place in the absence of inert liquid media and avoids the use of refrigerents. The high polymers obtained are especially valuable as electrical insulating material.

B.P. 677,635. Means for controlling hydraulic moulding presses and other hydraulic apparatus. A. Carter.

B.P. 677,641. Process of polymerizing ethylene. A. H. Stevens. Comm. from: Standard Oil Co.

Tough polymers are made in a continuous process by passing a gas stream of ethylene and a homogeneous peroxy catalyst through a reaction zone. The interior surfaces of the zone are coated (surface active substance) to prevent access of the polymer.

B.P. 677,667. Handles for attachment to cycle handle bars or other analogous uses. Apex Inflator Co., Ltd., A. W. Bailey.

B.P. 677,733. Synthetic resin composition. A. R. Burgess, Imperial Chemical Industries, Ltd.

An organic synthetic resin has incorporated not more than 10 per cent. of a certain metal chelate compound. The new compositions have improved stability to light, particularly to ultra-violet light.

B.P. 677,738. Solutions of acrylonitrile polymers and manufacture of synthetic fibres therefrom. To: American Viscose Corp. (U.S.A.).

B.P. 677,771. Process of producing high-molecular polyamides. To: Bata N.P. (Germany).

B.P. 677,778. Automatic winding devices for electric cables, cords or other flexible members. C. D. Harwood. To: Smart and Brown (Engineers), Ltd.

The principal parts are adapted for production as mouldings of plastics.

B.P. 677,785. Bobbins. H. N. Ewer, H. Hogg. To: G. and E. Equipment and Contractors, Ltd.; Barr, Mason, Ltd.

B.P. 677,805. Interpolymers. R. J. Wolf. To: B. F. Goodrich Co. (U.S.A.).

The addition of extraneous plasticizers for the production of thin films, sheets, rods, tubes is not required in vinyl resins and resin compositions when polymerization is effected of monomeric mixtures containing in definite proportions vinyl chloride, a vinyl ester of a certain acid (vinyl acetate or benzoate), and a higher alkyl acrylate.

B.P. 677,808. Spectacle frame. R. Tardy (France).

B.P. 677,817. Nail files. H. L. Ziele (Australia).

B.P. 677,825. Preparation of monomeric vinylidene cyanide. To: B. F. Goodrich Co. (U.S.A.).

B.P. 677,848. Production of synthetic resins. G. H. Foxon, Imperial Chemical Industries, Ltd.

The rapid polymerization of material comprising furfuryl alcohol can be controlled by adding a small amount of weaker acid salt to produce a buffering effect.

B.P. 677,853. Tubular containers for toothbrushes and like articles. Halex, Ltd., S. W. Snell.

B.P. 677,926. Production of moistureproof films. W. Berry, C. R. Oswin, J. Boyd. To: British Cellophane, Ltd.

An aqueous dispersion of partially condensed urea/formaldehyde resin is applied to the base film.

B.P. 677,945. Screw press, more particularly for extruding plastic materials. C. Pasquetti.

Two intermeshing screws are each subdivided into sections of different number of threads and different pitch in each section. The number of threads and the pitch increase towards the inlet end where the plastic material is fed from a hopper to the press under pressure.

B.P. 677,951. Process for making high polymers of alpha-methyl styrene. To: Dow Chemical Co. (U.S.A.).

The process relates to the separation of the high polymers from the catalyst, metallic sodium, which permits further use of the catalyst for the formation of additional amounts of polymer. The mixture of styrene and catalyst is maintained at between 0 and 30 degrees C. until 20 to 35 per cent. is polymerized, and then filtered. The polymer is recovered from the filtered solution. The very pure product is suitable, e.g., as insulating material for high-frequency current.

B.P. 677,968. Containers. To: Stokes Molded Products Inc. (U.S.A.).

The container (for the chemical industry; highly corrosive liquids) is moulded around the completely preformed bail and bearing assembly.

B.P. 678,019. Modified condensation products of propyl or higher alkyl phenols and formaldehyde. E. H. G. Sargent. To: Middlesex Oil and Chemical Works, Ltd.

B.P. 678,024. Dominoes. W. H. Freeman, W. H. Pardoe. Freeman and Pardoe.

Two or more layers are secured together, e.g., an opaque middle layer and transparent upper and bottom layer. Advertising matter may be impressed or cut in the under surface of the middle layer.

B.P. 678,033. Soap holder. A. R. Mackewn. To: New Hygiene, Ltd.

B.P. 678,083. Filling of ball-point fountain pens. J. C. Chatfield, C. S. Lefferdink (U.S.A.).

Piston, cylinder and tube may be made from plastics.

B.P. 678,160. Treatment of polymeric substances. J. W. Fisher, E. W. Wheatley, H. Bates.

The treatment is intended to raise the ironing point of textiles made from the polymer.

B.P. 678,216. Polymerization of vinyl-type compounds. To: N.V. de Bataafsche Petroleum Maatschappij (U.S.A.).

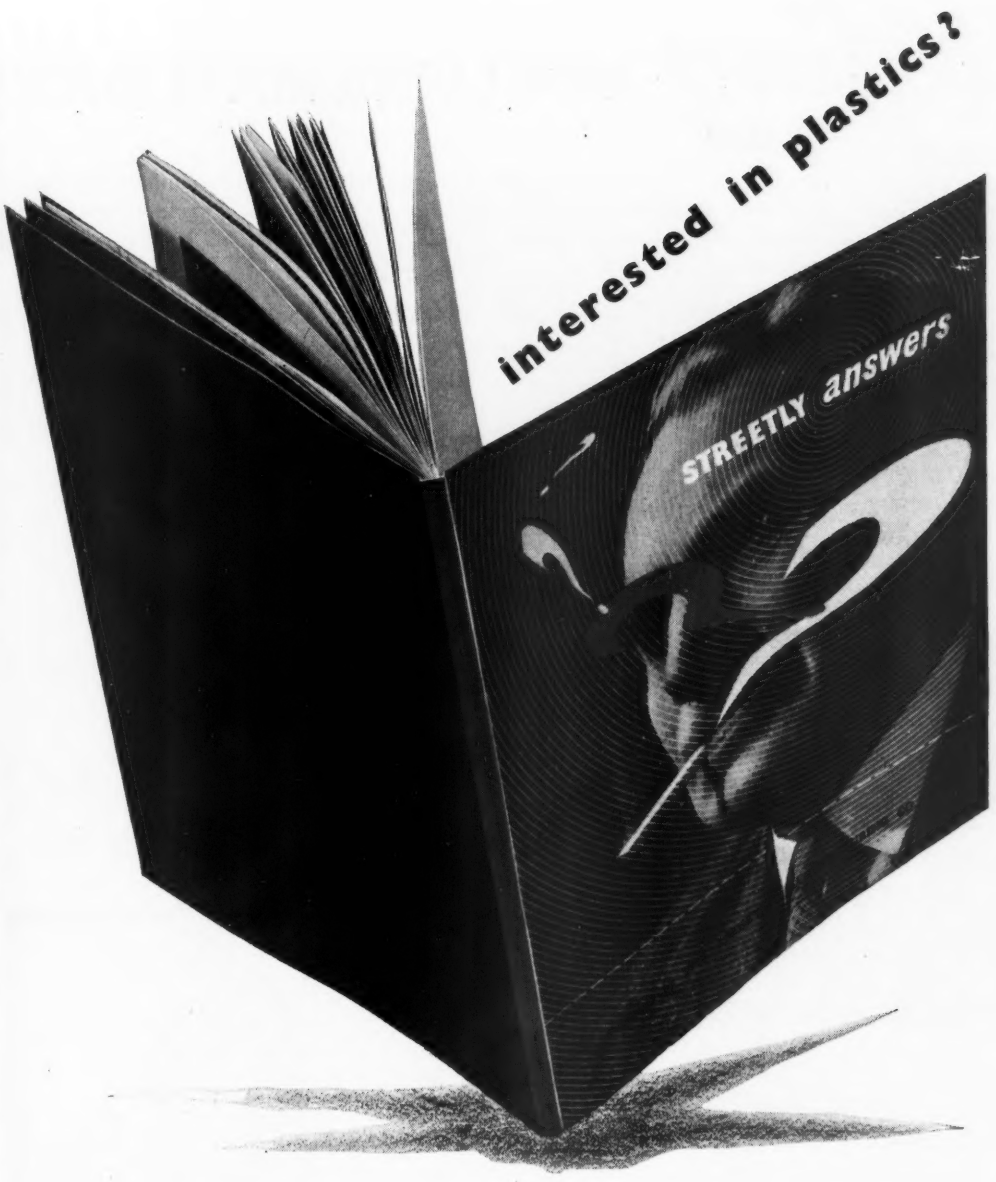
A catalyst of the organic per-esters of certain non-aromatic carboxylic acids is used. The products are colourless, possessing high molecular weight. Plasticized compositions have excellent colour, improved flexibility and tensile strength.

B.P. 678,217. Medical and surgical dressings. S. Holt. To: Imperial Chemical Industries, Ltd.

The dressing comprises a film, sheet, pad of pliable porous plastic material (polyvinyl chloride) having pores of 0.3 to 0.6 micron diameter.

B.P. 678,279. Stable emulsions. C. L. Mills, Jr. To: Monsanto Chemical Co. (U.S.A.).

A modified polystyrene latex is obtained which has all the properties of conventional polystyrene but resists freezing and other treatment which ordinarily precipitate the emulsions (coating compositions).



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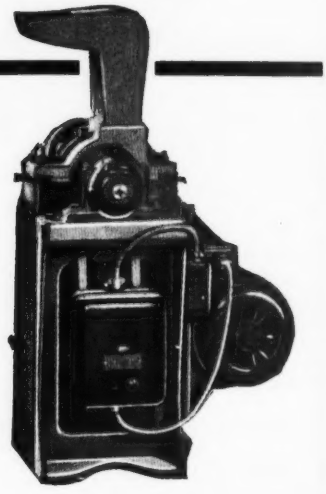

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Fig. 1

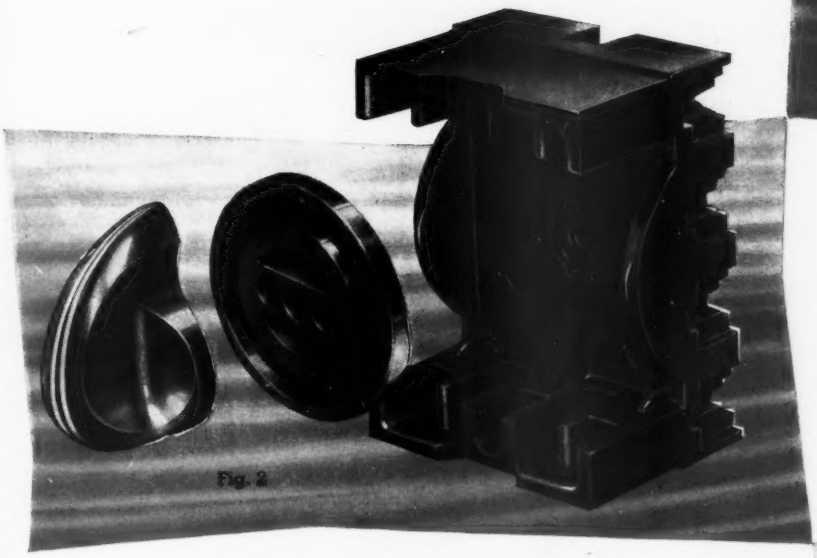

Fig. 2

25 Years of continuous service

TWENTY years ago, Insulators Limited commenced moulding for Arrow Electric Switches Ltd. The production of large quantities of component parts for Switch Gear called for precision, accuracy and the use of correct plastic materials.
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Fig. 2 shows fine examples of mouldings for Base and Cam incorporated in a slow make and break Switch which called for extensive skill in tool making design.
Fig. 3 also illustrates an example of slow make and break switch with modern styled control knob requiring sound moulding technique to ensure firm fit on the spindle.
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Please send details of your individual requirements and we will give you the full benefit of our twenty five years' experience in this industry.

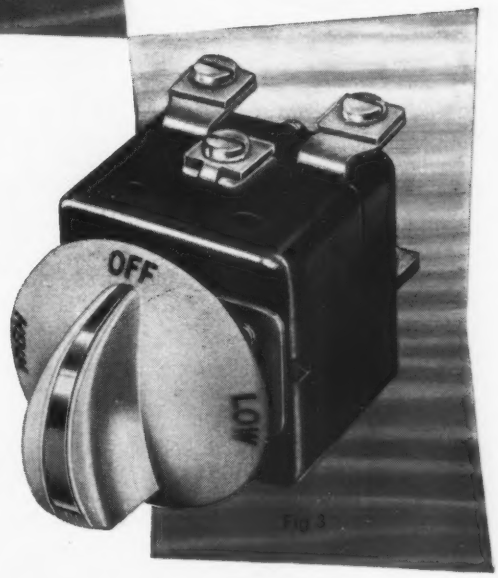

Fig. 3

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These pictures tell the perfect before-and-after story of the 'Fescol' process for hydraulic rams. The photograph on the left shows an untreated ram which has become corded and pitted by wear and corrosion. In this condition it has reached the end of its useful life.

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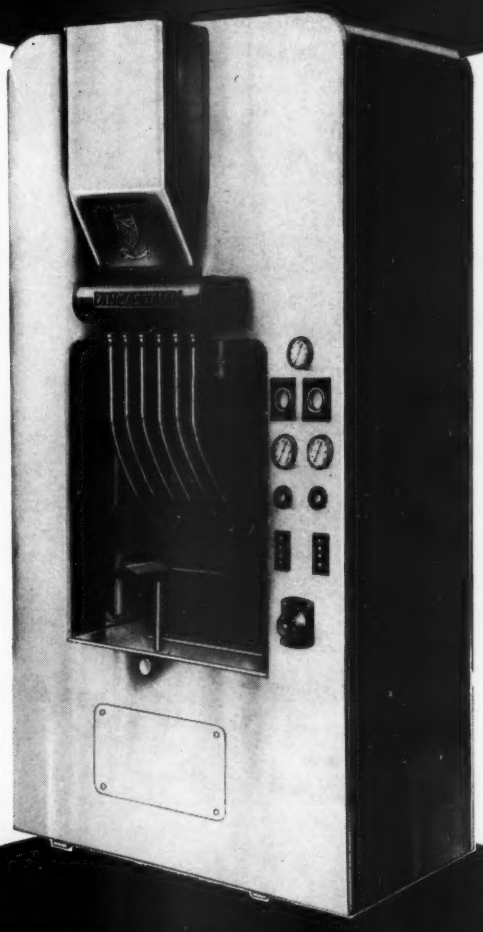

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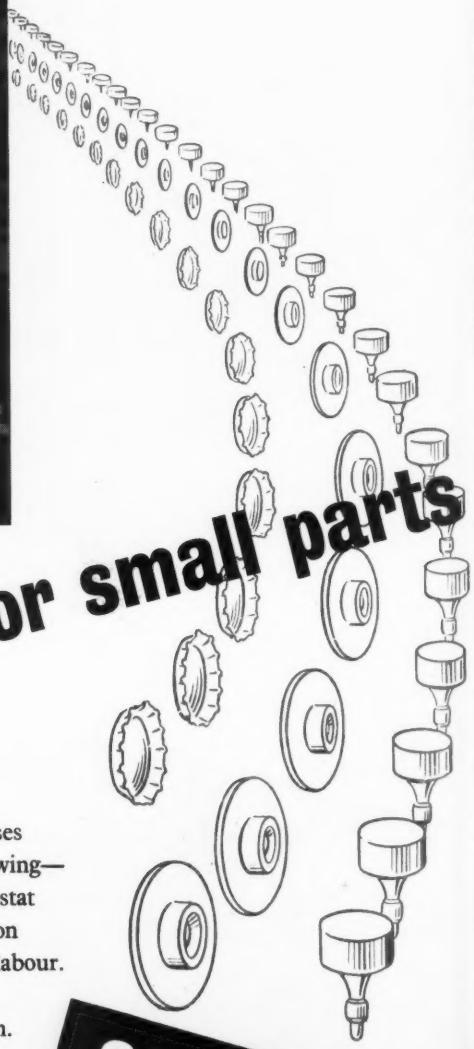

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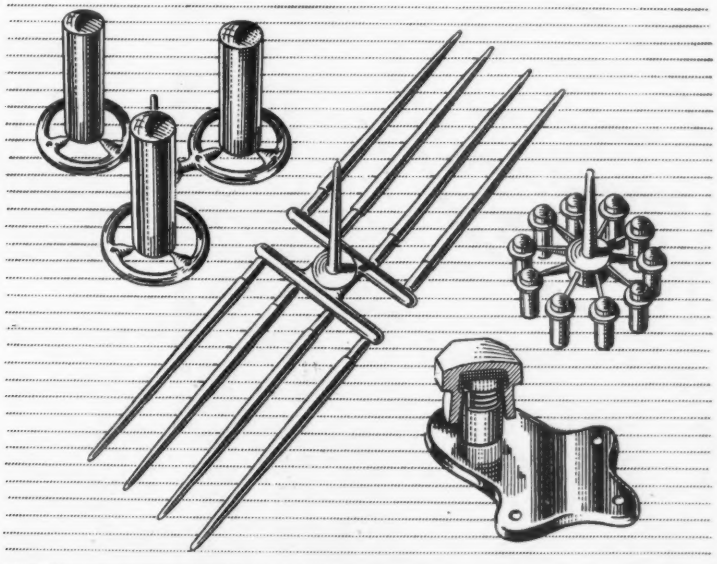

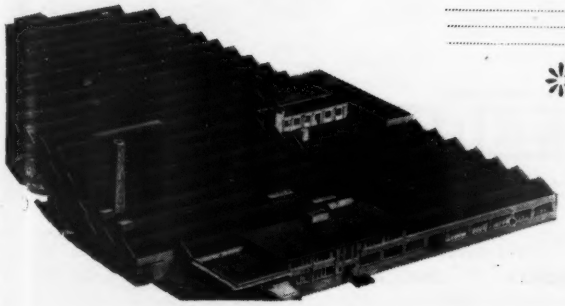

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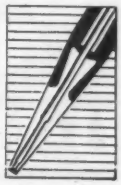

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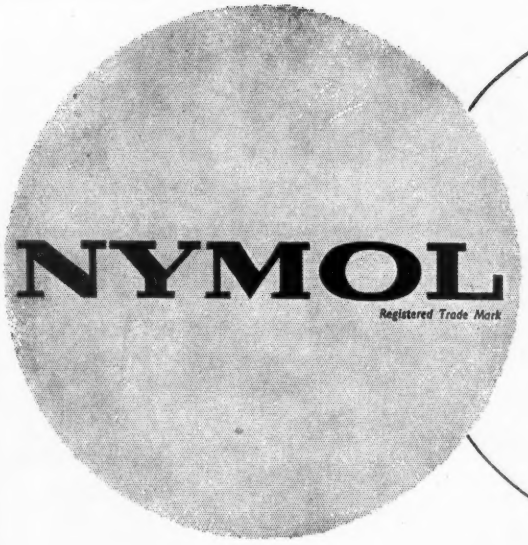

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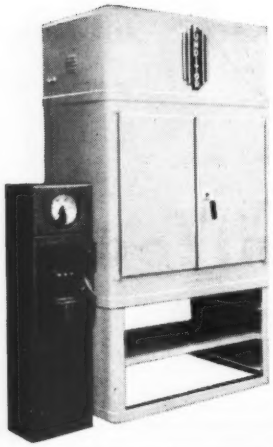

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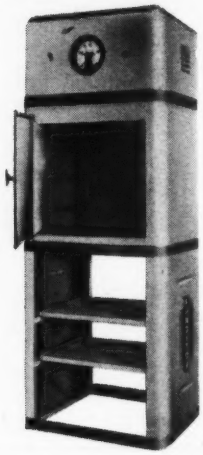

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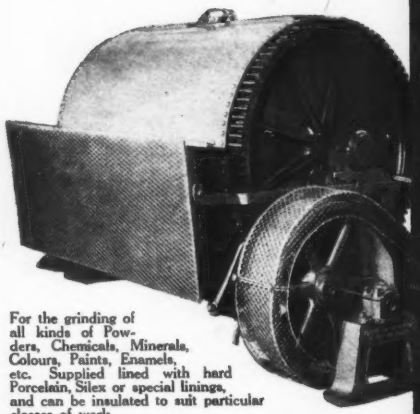

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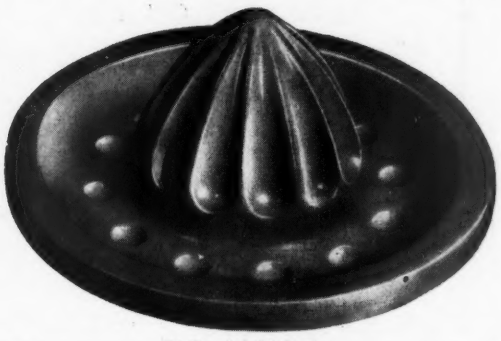

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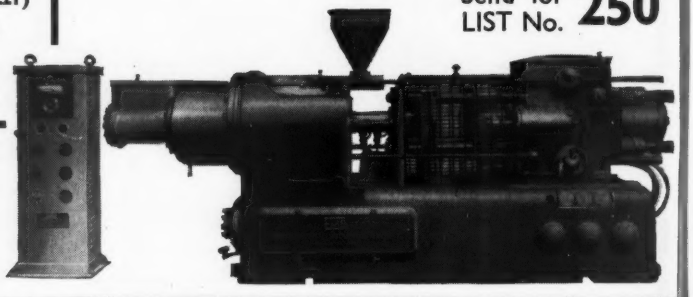

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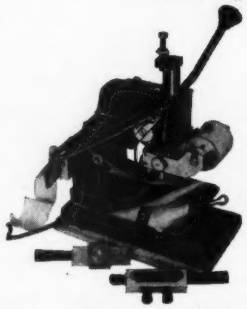

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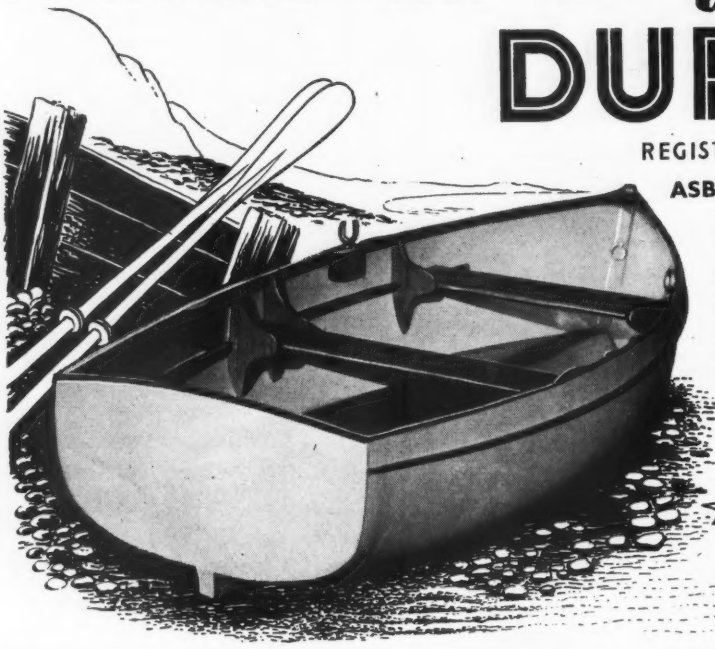

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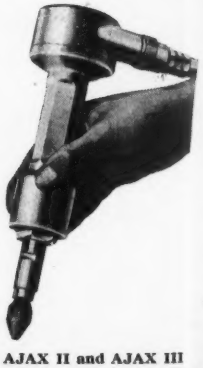

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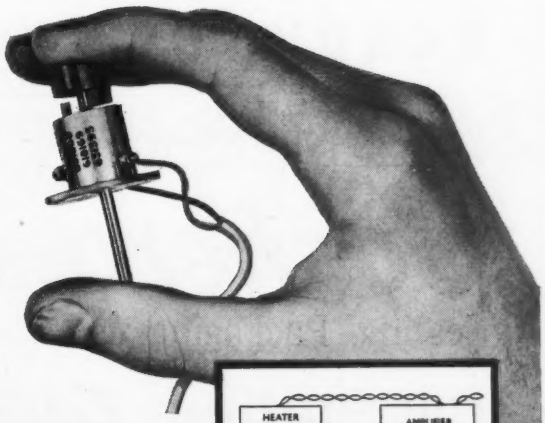

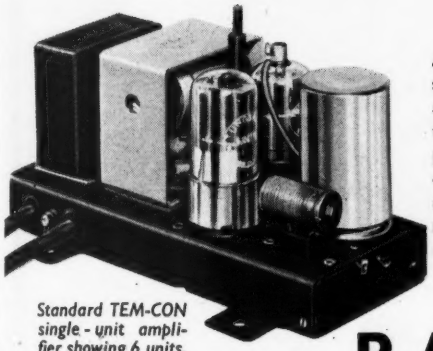

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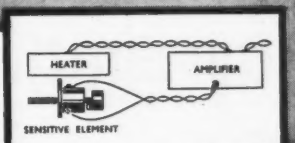

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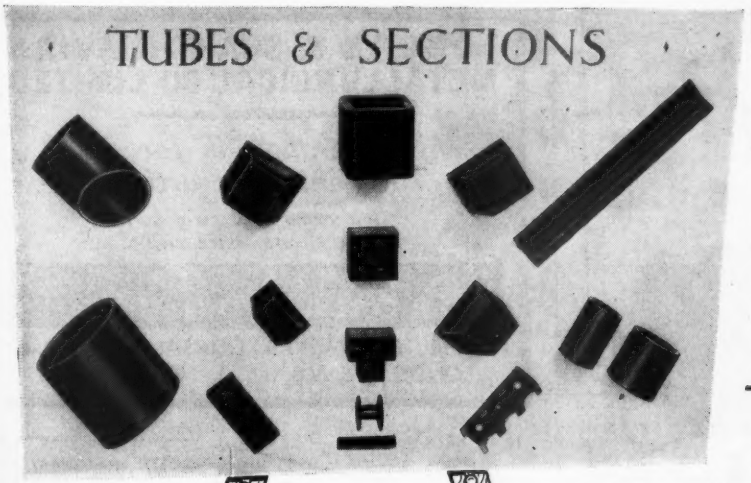

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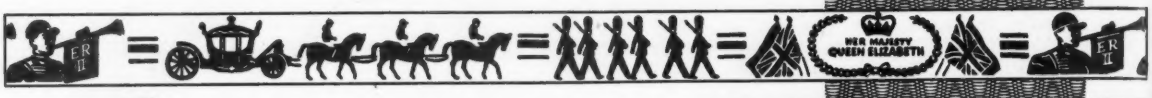

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INDEX TO ADVERTISERS

Name	Page
B	
Bakelite, Ltd.	42
Barber & Duffy, Ltd.	68
Birkby's Ltd.	1
Blackfriars Rotary Cutters, Ltd.	50
Blagden, Victor, & Co., Ltd.	69
B.L.C. (Exports), Ltd.	70
Blythe Colour Works, Ltd.	Inside Back Cover
Bradley & Turton, Ltd.	8
Bridge, David, & Co., Ltd.	24
Bridges, S. N., & Co., Ltd.	33
Briggs Bros., & Co.	64
British Celanese, Ltd.	29
British Electrical Development Association	15
British Industrial Plastics, Ltd.	45
British Moulded Plastics, Ltd.	44
British Oxygen Co., Ltd., The	25
British Resin Products, Ltd.	3
BX Plastics, Ltd.	Inside Front Cover
Byson Appliance Co., Ltd.	68
C	
Castle, John, & Co., Ltd.	68
Ceramic Platers, Ltd.	74
Chamberlain & Willows	70
Cinema-Television, Ltd.	35
Cohen, George, Sons & Co., Ltd.	59
Cole, R. H., & Co., Ltd.	32
Crystalate, Ltd.	2
D	
Dale, John, Ltd.	5
Dunford & Elliot (Sheffield) Ltd.	4
E	
Erinoid, Ltd.	Back Cover
Ether, Ltd.	62
Evans, Frederick W., Ltd.	71
Evode, Ltd.	58
F	
Ferguson, James, & Sons, Ltd.	46
Fescol	52
Firth, Thos., & John Brown, Ltd.	22
Foster, Yates & Thom, Ltd.	53
Funditor, Ltd.	58
G	
Gas Council, The	37
Geigy Co., Ltd., The	6
General Electric Co., Ltd., The	26, 40
Gosheron, John, & Co., Ltd.	66
Grist Plastics, Ltd.	9
H	
Haigh, John, & Co., Ltd.	60
Harris, Alfred, & Co. (Richmond) Ltd.	57
Hellerman, Ltd.	59
Herbert, Alfred, Ltd.	7
I	
Imperial Chemical Industries, Ltd.	Front Cover
Imperial Chemical Industries, Ltd.—Dyestuffs	41
Industrial Plastics, Ltd.	64
Insulation Equipments, Ltd.	30
Insulators, Ltd.	51
J	
Jobling, James	10
K	
Kays Industries, Ltd.	68
Kent Mouldings	63
L	
Lavino (London), Ltd.	14
Leaver & Hildrick	74
Lipton, L., Ltd.	68
London & Scandinavian Metallurgical Co., Ltd.	66
M	
Manesty Machines, Ltd.	71
Marshall, C. & C., Ltd.	68
M.C.M. (Tools), Ltd.	70
Monsanto Chemicals, Ltd.	20, 21
Myers, M., & Son, Ltd.	55
N	
Nu-Swift, Ltd.	70
P	
P.A.M., Ltd.	65
Pascall Engineering Co., Ltd., The	66
Plastic Engineers, Ltd.	57
Plastomatic, Ltd.	17
Printac, Ltd.	62
Projectile & Engineering Co., Ltd., The	31
Punfield & Barstow (Mouldings), Ltd.	36
R	
Radio Heaters, Ltd.	56
Reliance Trading Company	66
Resinoid & Mica Products, Ltd.	65
Riley Stoker & Co.	54
Rootes Mouldings, Ltd.	18
Rubber Improvement, Ltd.	61
S	
Sale, H. B., Ltd.	67
Scott Bader & Co., Ltd.	61
Shell Chemicals, Ltd.	39
Smith, Stanley, & Co.	55
Spicers, Ltd.	62
Steele & Cowlishaw, Ltd.	58
Sterling Moulding Materials, Ltd.	50
Stevens, Michael S.	70
Streetly Manufacturing Co., Ltd., The	49
Synthite, Ltd.	60
T	
Telco, Ltd.	71
Terry, Herbert, & Sons, Ltd.	12
Thompson & Norris Manufacturing Co., Ltd., The	28
Tullis, Russell & Co., Ltd.	19
Turner Bros. Asbestos Co., Ltd.	64
Tyne, Truck & Trolley Co., Ltd.	60
U	
U.K. Plastics, Ltd.	56
United Ebonite & Lorival, Ltd.	34
Universal Tools, Ltd.	11
Utilex, Ltd.	63
V	
Vinyl Products, Ltd.	38
V.M.C., Ltd.	71
W	
Whiting, L., Ltd.	70
Wickman, Ltd.	13
Wiggins Teape & Alex. Pirie (Sales), Ltd.	16
Williams (Hounslow), Ltd.	56
Windsor, R. H., Ltd.	23

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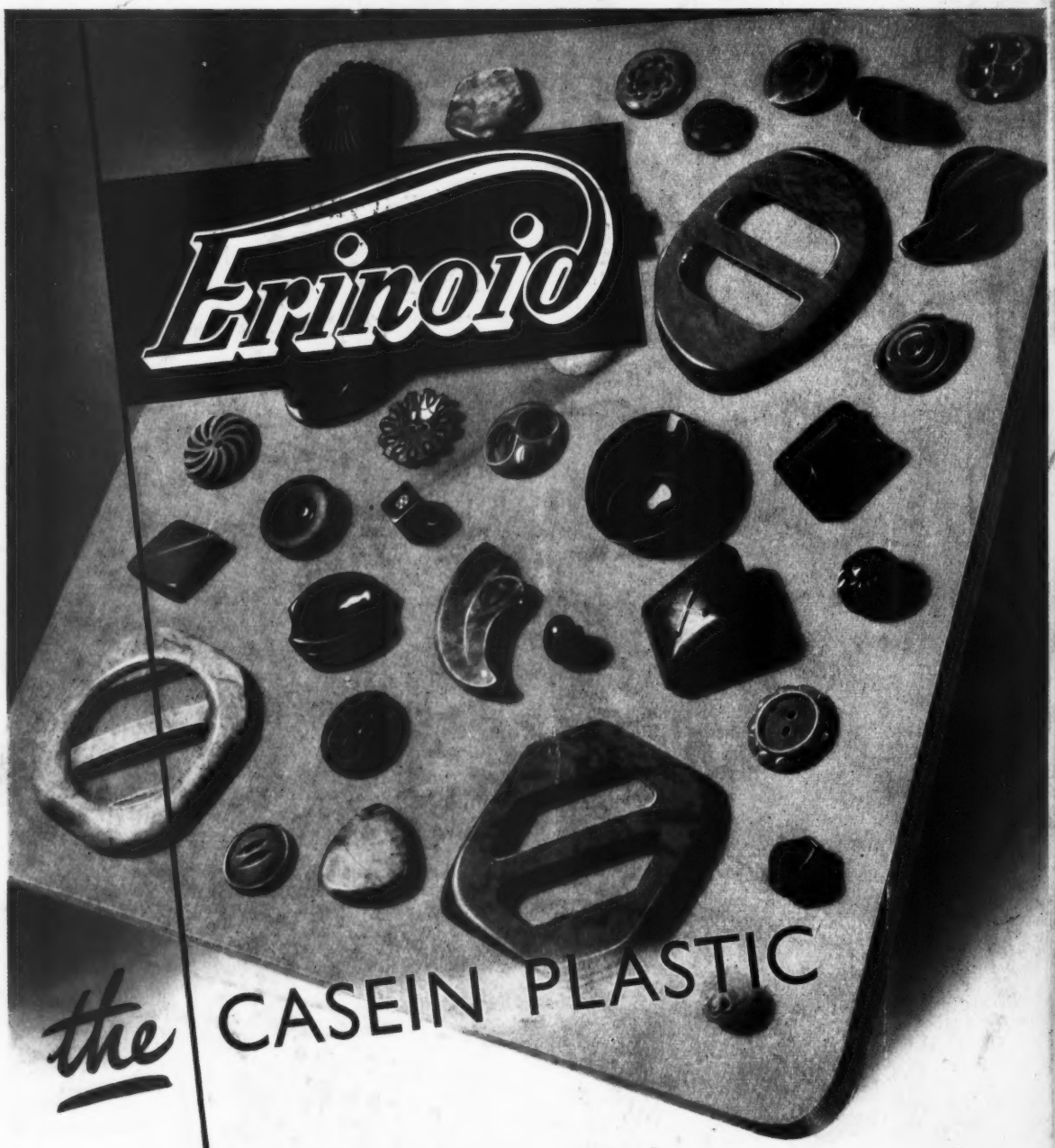

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